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A  
TREATISE  
ON  
THE BLOOD,  
Inflammation,  
AND  
GUN-SHOT WOUNDS.

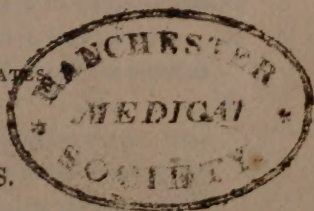
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*By the late JOHN HUNTER.*

ILLUSTRATED WITH PLATES

IN TWO VOLUMES.

VOL. II.



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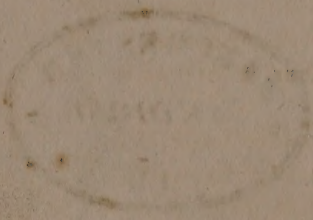
THE BLOOD

THE BLOOD



GUN-SHOT WOUNDS

THE LANCET



IN TWO VOLUMES

VOL. II

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## PART II.

### CHAPTER III.

#### *THE ADHESIVE INFLAMMATION.*

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I SHALL begin by treating of the nature and effects of what I have called the adhesive inflammation, as well as giving a proper idea of it. I shall also open the way to a clear understanding of the many phænomena which attend the suppurative inflammation; but as inflammation does not produce one effect only, but several, and as most of them take place about the same time, it is difficult to determine in the mind, which to describe first.

Inflammation in most cases appears to begin at a point; for at the very first commencement, all the local symptoms are within a very small compass, and they afterwards spread according to the violence of the cause; the disposition in



the parts for inflammation, and the nature of the surrounding parts themselves, which susceptibility in the surrounding parts may be either constitutional or local.

This is so much the case, that inflammation shall come on at once in a fixed point, giving great pain, and which shall be soon followed by tumefaction.

This is also the case with those inflammations which arise from accident, for all accidents are confined to fixed and determined limits, but the inflammation which follows is not; it spreads over a large extent, yet the inflammation is always the greater, the nearer it is to the first fixed point; and gradually becomes less and less in the surrounding parts, till at last it is insensibly lost in them.

This spreading of the inflammation is owing to continued sympathy, the surrounding parts sympathising with the point of irritation; and in proportion to the health of the surrounding parts and constitution, this sympathy is less; for we find in many states of parts, and many constitutions, that there is a disposition to this sympathy, and in such, the inflammation spreads in proportion.

I. *Action of the vessels in inflammation.*

THE act of inflammation would appear to be an increased action of the vessels,<sup>a</sup> but whatever action it is, it takes place, most probably, in the smaller vessels, for it may be confined almost to a point where nothing but the smallest vessels exist. The larger vessels may be considered as only the conveyers of the materials, for the smaller to act upon and dispose of according to the different intentions; however, inflammation in a part, is not only an action of the smaller vessels in the part itself, but in the larger vessels leading to it. This is proved by a whitlow taking place on the end of a finger; for although the inflammation itself shall be confined to the end of a finger, and the inflammatory sensation or throbbing be situated in this part, yet we can feel by our hands, when we grasp the finger, a strong pulsation in the two arteries leading to the inflamed part, while no such pulsation can be felt in the other fingers; and if the inflammation is very considerable, the artery, as high as the

<sup>a</sup> It may be here remarked, that the action of vessels is commonly supposed to be contraction, either by their elastic or muscular coats; but I have shewn that their elastic power also dilated them; and I have reason to believe their muscular power has a similar effect.

wrist, will be sensibly affected, which proves that the arterial system is at that time dilating itself, and allowing a much larger quantity of blood to pass than is usual. This is probably by continued sympathy.

Where the inflammation affects the constitution, the vessels of the system rather contract, and keep as it were stationary, which stationary contraction is more or less, according to the state of the constitution; in strong healthy constitutions, whose powers are equal to the necessary actions, or in parts that affect the constitution less, this contraction is less and less stationary.

The very first act of the vessels when the stimulus which excites inflammation is applied, is, I believe, exactly similar to a blush. It is, I believe, simply an increase or distension beyond their natural size. This effect we see takes place upon many occasions, gentle friction on the skin produces it; gently stimulating medicines have the same effect, a warm glow is the consequence, similar to that of the cheek in a blush; and if either of these be increased or continued, real inflammation will be the consequence, as well as excoriation, suppuration, and ulceration. This effect we often see, even where considerable mischief has been done; and I believe it is what always terminates the boun-



claries of the true inflammation. A musket-ball shall pass a considerable way under the skin, perhaps half way round the body, which shall be discovered and traced by a red band in the skin, not in the least hard, only a little tender to the touch; and it shall subside without extending farther. This appearance I shall term a blush; for although this may be reckoned the first act of inflammation, yet I would not call it inflammation, having produced a lasting effect; I should rather say, that inflammation sets out from this point, and that afterwards a new action begins, which is probably first a separation of the coagulating lymph, and the throwing it out of the vessels.

The parts inflamed appear to become more vascular; but how far they are really so, I am not certain, for this appearance does (at least in part) arise from the dilatation of the vessels, which allows the red part of the blood to go into vessels where only serum and coagulating lymph could pass when they were in a natural state, and till the newly extravasated substances become vascular; the effect is most probably owing wholly to the above cause.

This incipient enlargement of the vessels upon the first excitement of inflammation is satisfactorily seen in the following manner. Make an incision through the skin on the in-

side of the upper part of a dog's thigh, three inches long; by pulling the cut edges asunder, and observing the exposed surface, we shall see the blush or ash-coloured cellular membrane covering the different parts underneath, with a few arteries passing through it to the neighbouring parts; but in a little time we shall see these vessels increasing in size, and also smaller vessels going off from them, that were not before observable, as if newly formed or forming; the number and size shall increase till the whole surface shall become extremely vascular, and at last the red blood shall be thrown out in small dots on the exposed surface, probably, through the cut ends of the arteries that only carried the lymph before. This surface will become in time more opaque, and less ductile. Parts inflamed, when compared with similar parts not inflamed, shew a considerable difference in the size of the vessels, and probably from this cause bring an increased number to view. I froze the ear of a rabbit and thawed it again; this excited a considerable inflammation, an increased heat, and a considerable thickening of the part. This rabbit was killed when the ear was in the height of inflammation, and the head being injected, the two ears were removed and dried. The uninflamed ear dried clear and transparent, the vessels were distinctly seen ramifying through

the substance; but the inflamed ear dried thicker and more opaque, and its arteries were considerably larger.

In inflammation of the eye, which is commonly of the tunica conjunctiva, the progress of inflammation may, in part, be accurately observed, although not so progressively as in a wound. The contrast between the red vessel and the white of the eye, under this coat is very conspicuous, and although we do not see the vessels enlarging in this coat, yet we see the progress they have made, the white appears as if it was becoming more vascular, and these vessels larger, till at last the whole tunica conjunctiva shall appear as one mass of blood, looking more like extravasated blood than a congeries of vessels, although I believe it is commonly the last.

From these circumstances it must appear, that a much larger quantity of blood passes through parts when inflamed than when in a natural state, which is according to the common rules of the animal œconomy; for, whenever a part has more to do than simply to support itself, the blood is there collected in larger quantity; this we find to take place universally in those parts whose powers are called up to action by some necessary operation to be performed, whether natural or diseased.

As the vessels become larger, and the part

becomes more of the colour of the blood, it is to be supposed there is more blood in the part; and as the true inflammatory colour is scarlet, or that colour which the blood has when in the arteries, one would from hence conclude, either that the arteries were principally dilated, or at least, if the veins are equally distended, that the blood undergoes no change in such inflammation in its passage from the arteries into the veins, which I think is most probably the case; and this may arise from the quickness of its passage through those vessels.

When inflammation takes place in parts that have a degree of transparency, that transparency is lessened. This is, probably, best seen in membranes, such as those membranes which line cavities, or cover bodies in those cavities, such as the pia-mater, where, in a natural state, we may observe the blood-vessels to be very distinct. But when we see the blood-vessels fuller than common, yet distinct in such membranes, we are not to call that inflammation, although it may be the first step, as we find to be the case in the first action of the vessels in consequence of such irritation as will end in inflammation. As it may not, however, be the first step, there must be other attending circumstances to determine it to be the very first action of the vessels in inflammation, for as that appearance may



either belong to a briskness in the circulation in the part at the time, or the very first step in inflammation, their causes are to be discriminated by some other symptom; they are both a kind of blush, or an exertion of the action of the vessels; but when it is an effect of an inflammatory cause, it is then only that the inflammation has not yet produced any change in the natural structure of the parts, but which it will soon do.<sup>b</sup> What the action is, or in what it differs from the common action of the vessels, is not easily ascertained, since we are more able to judge of the effects than the immediate cause. However, it is probably an action of the vessels, which we can better observe than any diseased action in the body, for we can observe the state in which the arteries are, with their general effects; we feel, also, a different temperature respecting heat, yet the immediate cause may not be ascertainable.

The vessels, both arteries and veins, in the

<sup>b</sup> When this appearance is seen any where after death, it should not be called inflammation, even although we knew it was the first action of inflammation; for as we are then only looking out for the causes of death, or the symptoms prior to death, we are only to look out for such as can be a cause, and not lay hold of those that cannot possibly be a cause, which those first actions cannot be.

inflamed part are enlarged, and the part becomes visibly more vascular, from which we should suspect, that instead of an increased contraction, there was rather what would appear an increased relaxation of their muscular powers, being, as we might suppose, left to the elasticity entirely. This would be reducing them to a state of paralysis simply; but the power of muscular contraction would seem to give way in inflammation, for they certainly dilate more in inflammation than the extent of the elastic power would allow; and it must also be supposed, that the elastic power of the artery must be dilated in the same proportion. The contents of the circulation being thrown out upon such occasions, would, from considering it in those lights, rather confirm us in that opinion; and when we consider the whole of this as a necessary operation of nature, we must suppose it something more than simply a common relaxation; we must suppose it an action in the parts to produce an increase of size to answer particular purposes; and this I shall call the action of dilatation, as we see the uterus increase in size in the time of uterine-gestation, as well as the os tinæ in the time of labour, the consequence of the preceding actions, and necessary for the completion of those which are to follow.

The force of the circulation would seem to have some share in this effect, but only as a secondary cause; for I could conceive a part to inflame, or be in a state of inflammation, although no blood were to pass. As a proof of this, we may observe, that by lessening either the action of the heart, or the column of blood, inflammation is lessened; and I may also observe, that we have an increased pain in the inflamed part in the diastole of the artery, and a part inflamed by being gently pressed is made easier. Thus, a person with an inflammation in the fingers will find relief by gently pressing it in the other hand. These are strong proofs that it is not a contractile action of the vascular coat of the vessel; for in such a sensible state of vessels if they contracted by their muscular power, the pain would be in their systole; for we find in all muscles which are in a state of great sensibility, from whatever cause, that they cannot act without giving great pain. Thus an inflamed bladder becomes extremely painful when expelling its contents, an inflamed intestine in the same manner; I should say, therefore, that in inflammations the muscular coats of the arteries do not contract.

Whatever purpose this increase of the size of the vessels may answer, we must suppose it allows a greater quantity of blood to pass through



the inflamed part than in the natural state, which supposition is supported by many other observations.

The part inflamed, I have already observed, becomes to appearance more vascular than when in the natural state, and it is probable that it is really so, both from new vessels being set up in the inflamed part, as well as the new and adventitious uniting substance becoming vascular. Besides, the vessels of the parts are enlarged, so that the red blood passes further than common, which increases those appearances. But the brain appears to be an exception to these general rules; for in all diseases of the brain, where the effects were such as are commonly the consequence of inflammation, such as suppuration from accidents, I never could find the above appearances; the brain may, perhaps, go directly into suppuration, as sometimes the peritoneum does; but its slowness of going into suppuration after the accident, would make us suppose, *a priori*, that there was sufficient time for adhesions to form.

## II. *Of the Colour, Swelling, and Pain of Inflamed Parts.*

THE colour of an inflamed part is visibly changed from the natural, whatever it was, to

a red. This red is of various hues, according to the nature of the inflammation; if healthy, it is a pale red; if less healthy, the colour will be darker, more of a purple, and so on till it shall be a blueish purple, which I took notice of in the short sketch of the peculiar inflammations; but the parts inflamed will in every constitution be more of the healthy red when the parts inflamed are near to the source of the circulation, than when far from it. This increase of red appears to arise from two causes; the first is a dilatation of the vessels, whereby a greater quantity of blood is allowed to pass into those vessels which only admitted serum or lymph before.<sup>c</sup>

The second is owing probably to new vessels being set up in the extravasated uniting coagulating lymph.

This colour is gradually lost in the surrounding part if the inflammation is of the healthy kind, but in many others it has a determined edge, as in the true erysepelalous, and in some specific diseases, as in the small-pox, where its quick termination is a sign of health.

<sup>c</sup> The tunica conjunctiva of the eye when inflamed, is a striking instance of this; but the visible progress of inflammation I have already described in the experiment on the dog.

From the account I have given of the immediate effects of inflammation of the cellular membrane, in which I include the larger cavities, the volume of the part inflamed must be increased. This, when a common consequence of inflammation, is not circumscribed, but rather diffused, as the inflammation, however, begins in a circumscribed part, which is at least the case with that arising from violence; the inflammation I just now observed is always the greatest nearest to that point, and is gradually lost in the surrounding parts, the swelling of course is the greatest at, or nearest to this point, and it is also lost in the surrounding sound parts. This takes place, more or less, according to the constitution, or the situation of the inflammation; for if the constitution be strong and healthy, the surrounding parts will sympathize less with the point of irritation, so that inflammation and its consequences, viz. extravasation will be less diffused.

There will be less of the serum, and of course a purer coagulating lymph, so that the swelled parts will be firmer; but in some specific disease or dissimilar part, as a gland, it has a more determined edge, the surrounding parts not so readily taking on specific diseased action as in other cases. In this both the colour and swell-

ing correspond very much, since they both depend on the same principle.

This increase of volume is owing to the extravasation of the coagulating lymph, and some serum; in proportion to the inflammation, the degree of which depends on the causes above-mentioned, this effect is more or less, and therefore is greatest at the point of inflammation, becoming less and less as it extends into the surrounding parts, till it is insensibly lost in them.

The extravasation of the serum along with the coagulating lymph is, probably, not a separation of itself, as in a dropsy, but a part of it being separated from the lymph in the coagulation of that fluid, is squeezed into the surrounding cellular membrane, where there is but little extravasation, and where the cells are not united by it. Thus the circumference of such swellings is a little œdematous; but the whole of the serum, if there be a depending part, will move thither, and distend it considerably, as in the foot in consequence of an inflammation in the leg. But in most cases there is a continued extravasation of serum, long after the extravasation of the coagulating lymph is at an end; so that depending parts will continue œdematous, while the inflammation is resolving, or while suppuration, or even healing is going on.



The whole swelling looks like a part of the body only a little changed, without any appearance of containing extraneous matter; and indeed it is simply formed by an extravasation of fluids without their having undergone any visible or material change, except coagulation.

As few uncommon operations can go on in an animal body without affecting the sensations, and as the first principle of sensation arises from some uncommon action, or alteration being made in the natural position or arrangement of the parts, we should naturally suppose that the sensation would be in some degree according to those effects, and the sensibility of the parts. One can easily form an idea of an alteration in the structure of parts giving sensation which may even be carried to pain, but that the simple action of parts should produce sensations and even violent pain is but little known, or at least has been, I believe, but little attended to; all these effects, I think, may justly be included under the term spasm;<sup>d</sup> at least we

<sup>d</sup> How far a nerve from a part, or how far the *materia vitæ* of a part, can act so as to convey sensation I do not know; but we all know that an involuntary action of a voluntary muscle, or the spontaneous action of an involuntary muscle will produce it.

are led by analogy to suppose that they belong to that class.

By spasm I should understand a contraction of a muscle, without the leading and natural causes.

Thus the contraction of a muscle of the leg, called the cramp, gives considerable pain, often violent, as also the tetanus, and when in a less degree, as in the twinkling of the eye-lid, it gives only sensation, whereas if the muscles were to act by the will, no sensation would be produced.

We find that those sensations are more or less acute, according to the quickness or slowness of the progress of these causes, from whence we are naturally led to assign two causes which must always attend one another; for when both do not take place at the same time, the mind then remains insensible to the alteration. This is its being produced in a given time, for the alteration in the position of the parts may be produced so slowly, as not to keep pace with sensation, which is the case with many indolent tumors, ascites, etc. on the other hand this alteration in the natural position of parts may be so quick as to exceed sensation, and therefore there is a certain medium, which produces the greatest pain.

The actions I have been describing being

pretty quick in the effects, we cannot fail to see why the pain from the inflammation must be considerable; however, the pain is not the same in all the different stages. In the adhesive state of the inflammation it is generally but very inconsiderable, especially if it is to go no further, and is perhaps more of a heavy than an acute pain; when it happens on the skin it often begins with an itching; but as the inflammation is passing from the adhesive to the suppurative, the parts then undergo a greater change than before, and the pain grows more and more acute, till it becomes very considerable. The nerves also acquire at that time a degree of sensibility, which renders them much more susceptible of impression than when they are in their natural state; thus an inflamed part is not only painful in itself, but it communicates impressions to the mind independent of pain, which do not arise from a natural sound part. This pain increases every time the arteries are dilated, whence it would appear that the arteries do not contract by their muscular power, in their systole, for if they did, we might expect a considerable pain in that action which would be at the full of the pulse. Whether this pain arises from the distension of the artery by the force of the heart, or whether it arises from the action of distention from the force of the artery itself, is not easily

determined. We know that diseased muscles give much pain in their contraction, perhaps more than they do when stretched.\*

That the degree of inflammation which becomes the cause of adhesions gives but little pain, is proved from the dissections of dead bodies; for we seldom or never find a body in dissection which has not adhesions in some of the larger cavities; and yet it may reasonably be supposed, that many of these persons never had any acute symptoms, or violent pain in those parts; indeed, we find many strong adhesions upon the opening of dead bodies, in parts which the friends of these persons never heard mentioned, during life, as the subject of a single complaint.

That adhesions can be produced from very slight inflammation, is proved in ruptures, in consequence of wearing a truss; for we find the slight pressure of a truss exciting such action as to thicken parts, by which means the two sides of the sack are united, though there be hardly any sensation in the part; we also see, in

\* This is very evident in the bladder of urine when inflamed, for in the contraction of that viscus to expel the urine, there is more pain than in the dilatation; indeed the distention is gradual, and when the urine is wholly evacuated, the irritation produced by the contraction still continues, which produces a continuance of the straining.



cases where this inflammation arises from violence, that it gives little or no pain. A man shall be shot through the cavity of the abdomen, and if none of the contained parts are materially hurt, the adhesive inflammation shall take place in all the internal parts contiguous to the wound made by the ball, and yet no great degree of pain shall be felt. This assertion is still proved by the little pain suffered after many bruises, where there is evident inflammation; and in simple fractures, the pain from the inflammation is very trifling, whatever it may be from the laceration of the parts. But this will be according to the degree of inflammation, what stage it is in, and what parts are inflamed, as will be fully explained hereafter.

We find it a common principle in the animal machine, that every part increases in some degree according to the action required. Thus we find muscles increase in size when much exercised; vessels become larger in proportion to the necessity of supply, as for instance, in the gravid uterus; the external carotids in the stag, also, when his horns are growing, are much larger than at any other time; and I have observed, that in inflammation the vessels become larger, more blood passes, and there appear to be more actions taking place; but the nerves do not seem to undergo any change.

The nerves of the gravid uterus are the same as when it is in the natural state; neither do the branches of the fifth and seventh pair of nerves in the stag become larger; and in inflammation of the nerves, their blood-vessels are enlarged, and have coagulating lymph thrown into their intestines, but the nerve itself is not increased so as to bring the part to the state of a natural part, fitted for acute sensation, which shews that the motions of the nerves have nothing to do with the œconomy of the part, they are only the messengers of intelligence and orders. It appears that only the actions of the *materia vitæ* in the inflamed parts is increased, and this increase of action in the inflamed part is continued along the nerve which is not inflamed, to the mind, so that the impression on the sensorium is, probably, equal to the action of the inflamed *materia vitæ*.

The quantity of natural sensibility is, I believe, proportioned to the quantity of nerves, under any given circumstance; but I apprehend, the diseased sensibility does not take place at all in this proportion, but in proportion to the diseased action of the *materia vitæ*. Thus a tendon has very little sensation when injured in a natural state; but let that tendon become inflamed, or otherwise diseased, and the sensation shall be very acute.

It may not be improper to observe, that many parts of the body in a natural state, give peculiar sensations when impressed; and when those parts are injured, they give, likewise, pain peculiar to themselves; it is this latter effect, which I am to consider. I may also observe, that the same mode of impression shall give a peculiar sensation to one part, while it shall give pain to another. Thus, what will produce sickness in the stomach, will produce pain in the colon. When the sensation of pain is in a vital part, it is somewhat different from most of those pains that are common. Thus, when the pain arises from an injury done to the head, the sensation is a heavy stupifying pain, rendering the person affected unfit to pay attention to other sensations, and is often attended with sickness, from the stomach sympathizing with it.

When the pain is in the heart or lungs, it is more acute, and is very much confined to the part diseased.

When in the stomach and intestines, especially the upper part of them, it is a heavy oppressive sickly pain, but more or less attended with sickness, according to its pressure or proximity to the stomach; for when situated in the colon, it is more acute, and less attended with sickness.

We cannot give a better illustration of this, than by taking notice of the effects of a purge. If we take such a purge as will produce both sickness and griping, we can easily trace the progress of the medicine in the canal; when in the stomach it makes us sick, but we soon find the sickness becoming more faint, by which we can judge that it has proceeded to the duodenum, and then a kind of uneasiness, approaching to pain, succeeds; when this is the case, we may be certain that the medicine is passing along the jejunum; it then begins to give a sickish griping pain, which I conceive belongs to the ilium; and when in the colon it is a sharp pain, soon after which a motion takes place.

The liver, testicles, and uterus, are subject nearly to the same kind of pain as the stomach.

A tendon, ligament, and bone, give something of the same kind of pain, though not so oppressive; namely a dull and heavy pain, often attended with some little sickness, the stomach generally sympathizing in such cases.

But the skin, muscles, and the cellular membrane, in common, give an acute pain, which rather rouses than oppresses, if not too great. All of this will be further mentioned when we treat of each part.

One cause of this variety of sensations, ac-



According as the parts inflamed, are vital or not vital, seems to consist in the different systems of *materia vitæ* with which those parts are supplied, having, probably, nerves peculiarly constructed for this purpose; for all the parts which are supplied with branches from the *par vagum* and *intercostals*, affect the patient with lowness of spirits from the very first attack of the inflammation: the actions of those parts are involuntary, and therefore are more immediately connected with the living principle, and consequently that principle is affected whenever any thing affects these nerves.

The other system of the *materia vitæ*, when affected by this inflammation, rather rouses at first the constitution, which shows signs of strength, unless the parts have rather weak powers of recovery, such as tendon, bone, etc. or are far from the heart, in which cases the signs of weakness, sooner or later, appear: hence it would seem that this difference in the constitution, arising from the difference in parts and their situation, arises from the constitution having a disease which it cannot so easily manage, as it can in those parts which are not vital, and in parts that are near to the heart, which circumstances alone become a cause of irritation in the constitution.

III. *The Heat of Parts in Inflammation.*

WHEN I was treating of the blood, I observed that the heat of the animal was commonly considered as connected with that fluid; but as I had not made up my mind about the cause of the heat of animals, not being satisfied with the opinions hitherto given, I did not endeavour to offer any account of that property; but I shall now consider this power when the animal is under disease, where it would appear often to be diminished, and often increased, and of course the animal often becomes colder and hotter than its natural temperature.

There is an endeavour to bring the heat of a living body to the temperature of the surrounding medium, but in the more perfect animals this is prevented by the powers in the animal to support its own temperature, more especially in and near the vital parts; therefore, in making experiments, to ascertain any variation, it is not necessary to ascertain at the same time the temperature of the atmosphere.

Heat, I imagine, is a sign of strength and power of constitution, although it may often arise from an increased action either of weak constitutions or of weakened parts.

Heat is a positive action, while cold is the reverse, therefore producing weakness, and often arising from a diminished action of strong parts.

It has not yet been considered whether an animal has the power of producing heat equally in every part of the body; although from what is generally advanced on this subject, we are led to suppose that every part has this power; or whether it is carried from some one source of heat by the blood to every part; this may probably not be easily determined; but I am apt to suspect there is a principal source of heat, although it may not be in the blood itself, the blood being only affected by having its source near the source of heat.

That this principle resides in the stomach is probable, or at least I am certain that affections of the stomach will produce either heat or cold.

There are affections of the stomach which produce the sensation of heat in it, and the air that arises in eructations, feels hot to the mouth of the person; but whether these sensations arise from actual heat, or from sensation only, I have not been able to determine.

Stimulating substances applied to the stomach will produce a glow. Affections of the mind produce the same effect, which last cir-

cumstance might seem to contradict the idea of its arising from the stomach; but I suspect that the stomach sympathizes with those actions of the brain which form the mind, and then produces heat, which will be better illustrated in treating of cold. I suspect that the cold bath produces heat in the same way, from the sympathizing intercourse between the skin and the stomach.

That diseases augment or lessen this power in the animal is evident; for in many diseases the animal becomes much hotter, and in many others much colder than is usual to it. This fact was first discovered by simple sensation alone, both to the patients themselves, and the practitioner, before the absolute measurement of the degrees of heat by instruments was known; but it was impossible that such knowledge of it could be accurate, for we find by experiment, that the measurement of degrees of heat by sensation is very vague. This happens because the variations in the degrees of heat in ourselves (which in such experiments is the instrument) is not of one standard, but must vary pretty much before we are made sensible of the difference, and therefore there can be only a relative knowledge respecting our own heat at the time. But now our measurement is more determined, and can be brought even nearer to



the truth than is absolutely necessary to be known in disease.

The increase and decrease of the heat of an animal body may be divided into constitutional and local. The constitutional arises from a constitutional affection, and may arise primarily in the constitution itself; or it probably may arise secondarily, as from a local disease with which the constitution sympathizes; but of this I am not yet certain, for from several experiments made to ascertain this point, it seemed to appear that local inflammation had little power of increasing the heat of the body beyond the natural standard, although the body was under the influence of the inflammation by sympathy, called the symptomatic fever; but if the heat of the body is below the natural heat, or that heat where actions, whether natural or diseased, are called forth, then the heat of the body is roused to its natural standard.<sup>f</sup>

As it is the principle of increase of local heat in inflammation I am now to consider, it should be first ascertained how far such a principle exists in a part, and what that principle may be; the constitutional principle being in some measure not to the present purpose, although it may

<sup>f</sup> Vide Animal Economy, page 99.

throw some light on the difference between the powers of the constitutional, and those of the local principle. It is said, that disease, as fever, has been known to raise the heat of the body to twelve degrees above the natural heat; and if so, then there is in such cases either an increased power or an increased exertion of that power; and to know whether this arises only from a constitutional affection at large, or whether it can take place in parts when the constitution is affected by those parts, is worthy of inquiry.

The principal instance of supposed increased local heat is in inflammation; and we find that external parts inflamed do actually become hotter; but let us see how far the increase goes. From all the observations and experiments I have made, I do not find that a local inflammation can increase the local heat above the natural heat of the animal; and when in parts whose natural heat is inferior to that which is at the source of the circulation, it does not rise so high; those animals too, which appear to have no power either of increase or decrease in health, naturally appear to be equally deficient in disease; as will be seen in the experiments.

I suspect that the blood has an ultimate standard heat in itself, when in health, and that

nothing can increase that heat but some universal or constitutional affection; and probably the sympathetic fever is such as has no power in this way, and that the whole power of local inflammation is only to increase it a little in the part, but that it cannot bring it above the standard heat at the source, nor even up to it in parts that naturally or commonly do not come up to it, as just abovementioned.

As inflammation is the principal instance capable of producing local increased heat, I have taken the opportunity of examining inflammations, both when spontaneous and in consequence of operations. I have also made several experiments for that purpose, which are similar to operations, and cannot say that I ever saw, from all these experiments and observations, a case where the heat was really so much increased, as it appeared to be to the sensations.

### *Experiments on Internal Surfaces.*

#### EXPERIMENT I.

A man had the operation for the radical cure of the hydrocele, performed at St. George's Hospital. When I opened the tunica vaginalis, I immediately introduced the ball of the thermometer into it, and close by the side of the testicle. The mercury rose exactly to ninety-two degrees. The cavity was filled with

lint dipped in salve, that it might be taken out at will; the next day, when inflammation was come on, the dressings were taken out and the ball of the thermometer introduced as before, when it arose to ninety-eight degrees and three-fourths exactly.

Here was an increase of heat of six degrees and three fourths; but even this was not equal to that of the blood, probably at the source of the circulation in the same man. This experiment I have repeated more than once, and with nearly the same event.

As the human subject cannot always furnish us with opportunities of ascertaining the fact, and it is often impossible to make experiments when proper cases occur, I was led to make such experiments on animals, as appeared to me proper for determining the fact; but in none of them could I ever increase the inflammatory heat so as to make it equal to the natural heat of the blood at its source.

#### EXPERIMENT II.

I made an incision into the thorax of a dog: the wound was made about the centre of the right side, and the thermometer pushed down, so as to come in contact, or nearly so, with the diaphragm. The degree of heat was one hundred and one; a large dossil of lint was put



into the wound to prevent its healing by the first intention, and covered over by a sticking plaster. The dog was affected with a shivering. The day following the lint was extracted and the thermometer again introduced: the degree of heat appeared exactly the same, viz. one hundred and one. This dog recovered.

### EXPERIMENT III.

An oblique incision was made about two inches deep into the gluteal muscles of an ass, and into this wound was introduced a tin canula, about an inch and half long, so that half an inch of the bottom of the wound projected beyond the canula; into this canula, was introduced a wooden plug, which projected half an inch beyond the canula, so as to fill up the bottom of the wound, and which kept that part of the wound from uniting. The whole was fastened into the wound by threads attached to the skin.

Immediately upon making the wound, the ball of the thermometer was introduced into it to the bottom, and the mercury rose to one hundred degrees exactly, as it did also at the same time in the vagina.

On the next morning the wooden plug was taken out, and the ball of the thermometer (being previously warmed to ninety-nine degrees)

was introduced down to the bottom of the wound, which projected beyond the canula, and the mercury rose to one hundred degrees. The wooden plug was returned and secured as before. In the evening the same experiment was repeated, and the mercury rose to one hundred degrees. Friday morning it rose only to ninety-nine degrees. Friday evening it rose to near one hundred and one degrees and a half. Saturday morning, ninety-nine degrees, and in the evening one hundred degrees.

A similar experiment to this was made on a dog, and the heat was one hundred and one degrees. The day following the heat was the same, as also on the third day, when suppuration was taking place.

#### EXPERIMENT IV.

Although in the experiment upon the dog, by making an opening into the thorax, so as to excite an inflammation there, and to affect his constitution, the heat of the part was not increased; yet in order to be more clear with regard to the result of such an experiment, a wound was made into the abdomen of an ass, and a solution of common salt and water thrown in (about a handful to a pint of water), to excite an universal inflammation in the cavity of

the abdomen. This produced great pain and uneasiness, so as to make the animal lie down and roll, becoming as restless as horses when griped.

The next morning, Friday, the thermometer was introduced into the vagina, and the mercury stood at ninety-nine degrees and a half, nearly the same heat as before the experiment; in the evening one hundred and one degrees and a half. Saturday morning, one hundred degrees and a half; evening, a hundred degrees and a half. The vagina, therefore, was not rendered hotter by an inflammation which produced what we may call the sympathetic fever.

The animal was now killed, and on examining the abdomen, the side where the wound was made appeared much inflamed, as well as the intestine opposite to this part. All of them adhered together, and the intestines surrounding this part of the adhesions had their peritoneal coat become extremely vascular, and matter was formed in the abdomen.

But that the heat of a part can be increased above the common standard of a healthy person is certain, when it is such a part as is naturally of the standard heat; as for instance, the abdomen. For in lord Hertford's servant, who was tapped eight times, and seven of them in thirteen weeks, the seventh time I held the ball of

a thermometer in the stream, as it flowed from the canula of the trochar, and it raised the mercury to one hundred and one degrees, exactly, through the whole time. Twelve days after I tapped him the eighth time, the water was pretty clear; when I held the thermometer in the stream, it rose to one hundred and four degrees; we must, I think, suppose that the general heat of the man would also be one hundred and four degrees.

*Experiments on secreting Surfaces.*

EXPERIMENT I.

I took the degree of heat of a dog's rectum, by introducing the thermometer about three inches; and when it was ascertained, four grains of corrosive sublimate were dissolved in two ounces of water, and the solution thrown up the rectum. The day following the thermometer was again introduced, and then I found the heat somewhat increased, but not quite a degree. As far as one might judge from external appearances, the rectum was very much inflamed, as there was a considerable external swelling, forming a thick elevated ring round the anus.



## EXPERIMENT II.

I introduced into the rectum of an ass, the thermometer, and the mercury rose to ninety-eight degrees and a half, exactly; this was repeated several times with the same result. I then threw up the rectum an injection of flour of mustard and ginger, mixed with about a pint of water. About twelve hours after, I introduced the thermometer, and it rose to ninety-nine degrees and a half.

The injection was repeated several times, but the heat did not increase.

## EXPERIMENT III.

To irritate the rectum still more, I threw up a solution of corrosive sublimate; and about twelve hours after, I introduced the thermometer, and found no increase of heat. Twenty hours after, I introduced the thermometer; but the heat was the same. Sixty hours after the injection, the thermometer being introduced, the mercury rose to one hundred degrees, exactly. This injection had irritated so much, as to give a very severe tenesmus; and even blood passed.

## EXPERIMENT IV.

The natural heat of the vagina of a young ass was one hundred degrees. A solution of corrosive sublimate, as much as would dissolve in a tea-cup full of water, viz. about ten grains, was injected into the vagina. In about two hours after, the mercury fell to ninety-nine degrees. Thursday morning, ninety-nine degrees; evening, one hundred. Friday morning, ninety-nine; evening, near to one hundred and one. Saturday morning, ninety-nine; evening, one hundred degrees.

This experiment was repeated several times upon the same ass, with the same result.

In these experiments it can hardly be said, that the heat was increased. That the inflammation had been raised to a very considerable degree was plain, for it produced a discharge of matter which was often bloody, and upon killing the ass for another experiment, the following appearances were found in the uterus.

The horns of the uterus were filled with serum, and the inflammation had run so high by the stimulating injections which were used for the experiments on the vagina, that the coagulating lymph had been thrown out so as almost to obliterate the vagina, uterus, etc. by those adhesions which are the ultimate effects of inflammation on secreting canals, while sup-

puration is the ultimate effect of inflammation on internal surfaces: there were no signs of inflammation on the external surface of the uterus, which is covered by the peritoneum.

It may just be remarked, that in most of those experiments the heat in the morning was a degree less than in the evening; and I may also remark, that this is commonly the case in the natural heat of the animal.

I wished to know whether such animals as have little or no power of varying their natural heat, had a power of increasing their heat in consequence of injuries, for which purpose I opened into circumscribed cavities in frogs, toads, and snails; and at different periods, after the opening was made, the thermometer was introduced. As the heat of those animals is principally from the atmosphere, the external heat is to be connected with the experiments.

*November 27, 1788.*

A healthy toad and frog, after having the heat in the stomach ascertained, had openings made through the skin of the belly, large enough to admit a thermometer, and the orifice was kept open by a piece of sponge.

Atmosphere . . . . .	36°
Stomach of both . . . . .	40°
Under skin of the belly	40°

	Atm.	Frog.	Toad.	Stom.
	Under the skin.			
Half an hour after the opening . . . . }	35°	40°	40°	40°
Hour and a half . . . .	35	39	39	
Two hours and half . . . .		39	39	

The abdomen was now opened, and a piece of sponge kept in the orifice.

	Atm.	Frog.	Toad.	Stom.
	Abdomen.			
The heat . . . . .	36°	40°	40°	40°
Hour & half after opening	36	39	39	39
Four hours and a half . . . .	38	39	39	

Part of the left oviduct protruded of the natural colour and appearance.

	Atm.	Frog.	Toad.	Stom.
Nine hours after . . . .	38°	38°	38°	38°
Twenty-one hours & a half	35	35	35	35

The protruded oviduct was more vascular and of a uniformly red appearance; it was returned into the belly and retained there.

	Atm.	Frog.	Toad.	Stom.
Twenty-four hours . . . .	32°	32°	32°	32°
Forty-six hours . . . .	34	34	34	34

The toad died, and the frog was become very weak and languid: part of the oviduct protruded, and had the small vessels loaded with blood.



It lived one hundred and eighteen hours, that is, seventy-two longer than the toad, during which period its heat corresponded with the atmosphere.

Upon examining the abdomen after death, there were no adhesions nor any appearances from inflammation, except on the protruded oviduct.

Some healthy shell-snails had openings made into the lungs, and their heat ascertained at the following times.

	Atm.	Snail.
The heat at the time . . .	34°	38°
One hour and a half . . .	32	32
Six hours and a half . . .	32	35
Ten hours . . . . .	31	36
Twenty-four hours . . . .	30	30

To ascertain the standard heat of a snail.

	Atm.	Snail.
A fresh lively snail had } its heat in the lungs }	30°	36°
Another . . . . .	28	35
Another . . . . .	30	37

*Experiments to ascertain the heat of worms, leeches, and snails, when compared with the atmosphere, and the changes produced in their heat, by inflammation.*

## EXPERIMENT I.

Heat of the air in the room . . .	56°
———— water in the room . . .	57°
———— some earth-worms . . .	58½°

## EXPERIMENT II.

Water as a standard . . . . .	56¼°
Leeches in the same quantity . .	57°

## EXPERIMENT III.

Water as a standard . . . . .	56°
Fresh egg . . . . .	55
Leeches alone . . . . .	60
Worms alone . . . . .	57
Air . . . . .	54
Worms . . . . .	58
Leeches } two hours after being wounded	57
Slugs } . . . . .	58
Air . . . . .	55
Worms . . . . .	55
Leeches } twenty-four hours after being wounded	55
Slugs } . . . . .	55

They were all very weak and dying.

#### IV. *Of the production of cold in inflammation.*

THE production of cold is certainly an operation which the more perfect animals are endowed with; and this power would appear to be both constitutional and local, similar to the power of producing heat. As the word inflammation implies heat, and has been used to express that action of the vessels where heat is commonly an effect, it may seem strange that we should treat of cold in the action of inflammation; but probably we have no action in the body that is not attended with an occasional production of cold; how far this takes place in parts I do not know; but that it takes place constitutionally, from almost every affection, is evident, whether it be inflammatory fever, or local inflammation. As an animal has no standard of cold, but at the source, which is also the standard of heat, it is, perhaps, impossible to ascertain with certainty the degree of cold produced either by disease, or from the surrounding cold; but perhaps by comparing the part suspected of being colder than is natural from disease, with a similar part under the same external influence of heat and cold, as for instance, one limb with the other, or one hand with the other, a pretty fair inference may be

made; and we often find that diseased parts shall become extremely cold, while from other circumstances than disease, they should not be so.

I suspect that coldness in disease arises either from weakness, or a feel or consciousness of weakness, in the whole constitution or a part, joined with a peculiar mode of action at the time.

Thus we have many constitutional diseases beginning with absolute coldness, which seems afterwards to terminate in a sensitive coldness only, as the cold fit of an ague; for I apprehend that the sickness which generally precedes such complaints, produces universal cold, and once having produced the action of the body arising from absolute cold, the action goes on for some time, although the cause no longer exists, which continues the sensation; and although the absolute coldness is gone, yet the action of the parts, which is a continuation of, and therefore similar to the action of the absolute cold, is capable of destroying itself by producing the hot fit, if there be power or disposition.

That weakness, or a feel of weakness, produces cold is evident; and that universal or constitutional cold arises from the stomach is also evident; for whenever we are made sick an universal coldness takes place; and this is best



proved by producing sickness on animals that we can kill, or that die while they are under these affections of the stomach. The experiments I made to ascertain this were not conducted with great accuracy, as I trusted in them entirely to my own sensations or feelings.

EXPERIMENT. I threw three grains of tartar emetic into the veins of a healthy bitch, the quantity of water near an ounce. In about twenty minutes she had a stool, and voided some single tape worms. Some of the stools were extremely thin, and made up principally of bile. Some time after she had two more stools, which were thin and bilious. She continued pretty easy for about three hours, but became a little convulsed, which increased, and at last she became senseless, with little twichings; hardly breathing, except with the diaphragm, and having a low, slow pulse. She was very cold to our feel, when applying our hand on the skin of the body. In about ten or twelve hours after the injection, she died.

EXPERIMENT. I repeated the above experiment on another bitch, adding a full grain more to the medicine. She vomited in less than a minute after it was thrown in, and strained excessively hard, throwing up a great deal of froth, which was only the mucus of the stomach mixed up with the air in the act of

retching. In less than three minutes she had a stool, which was pretty loose and partly of the natural appearance. She continued retching and purging for above an hour, and was extremely uneasy; at last she got into a dark corner and lay there, frothing at the mouth, was taken with convulsive twitchings like the former, and died in about five hours after the injection. I opened her body immediately after death, and found the intestines, liver, and heart not so warm as we usually find them.

I have known people who had affections of the stomach and bowels, say, that they had plainly the feeling of cold in their bellies. I knew a gentleman, who told me, that often when he threw the wind off his stomach, it felt cold to his mouth and even to his hands, which was by much the best guide respecting sensation.

A lady near seventy years of age, has a violent cough, which often makes her puke, and what comes off the stomach feels like ice to the mouth.

Affections of the mind also produce constitutional coldness, but they are such affections as the stomach sympathizes with, producing sickness, shuddering, &c.

A disagreeable idea or sight will sometimes give a quick sensation of sickness, and the skin

shall sympathize with the stomach, it shall appear to begin, as it were, in the mouth or throat, as if something there had a tendency to come up; the muscles of the neck shall become convulsed, and the head shall be violently shaken; from thence a disagreeable feeling shall spread over the whole body, passing directly down the back to the feet; commonly expressed by saying "one's flesh creeps;" and hence the words shudder and horror, express mental as well as bodily affections. Another action shall be joined with the cold, viz. the action of sweating, so that a cold sweat shall take place over the whole body. This cold shall be partial, for under many diseases a partial cold sweat will come on, while other parts remain tolerably temperate.

V. *Of the time the adhesive inflammation commences after its cause; and in what cases and parts it is imperfect in its consequences.*

It will be often impossible to determine the distance of time between the impression which becomes the cause of inflammation, and the action itself, which will depend upon two circumstances, viz. the nature of the exciting cause, and the susceptibility for such action in the parts.

In the exposure of internal surfaces, inflammation is perhaps sooner brought on than in most others; for the incitement is immediate, and there is no remission in the cause itself.

In specific diseases its time is perhaps more regular, each having a determined interval between the application of the exciting cause and the appearance of the disease, although even in some of these there is a vast difference in the time after contamination, but in those arising spontaneously it must be uncertain; yet in some cases it can be pretty well ascertained, supposing sensation the first effect of the inflammatory impression; and in such instance we often find it very rapid. They shall be attacked with a violent pain in the part, so much so as hardly to be able to bear it, which shall be immediately succeeded with a violent inflammation.

A lady was walking in her garden, and at once attacked with a violent pain in the middle of the fore part of the thigh, which made her immediately lame; soon after, the skin appeared discoloured, which spread nearly over one half of the thigh; this part became thick and swelled, which appeared to go as deep as the bone; it afterwards suppurated, all in a few days; this appeared to be a well-marked case.

The commencement of inflammation after accidents is more easily ascertained, for we must



date it from the accident, and we find it not immediate; for after a wound has been received inflammation does not begin for twelve, eighteen, or twenty-four hours.

It sometimes happens, however, that the adhesive state cannot set bounds to itself, and therefore cannot set bounds to the suppurative. This may be owing to two causes; the one is, the violence of the inflammation, and quickness of the attack of the suppurative spreading before parts have had a sufficient union, and even perhaps joined with a species of suppuration from the very first, so that union is prevented. Secondly, the inflammation may, I suspect, be of the erysepelatous kind, especially when there is a tendency, from the beginning, to mortification.

This mixing of the suppurative with the adhesive, or the hurrying on of the suppurative, or this mixture of the erysepelatous with the others, I have frequently seen in the abdomen of women who have been attacked with the peritoneal inflammation after child-birth, and which from these circumstances became the cause of their death.

In such cases we find matter mixed with coagulating lymph, as if formed with it, for, without having been formed with it, it could not have mixed with it after coagulation; we find also coagulating lymph mixed with the

matter, as it were, separated from the inflamed surface by the formation of the matter; and in those cases where there is a tendency to mortification from the beginning, as in strangulated ruptures, we often find the adhesive and suppurative inflammation going hand in hand. All of these causes and effects account for the violence of the symptoms, the quickness of the progress of the disease, and its fatal consequences beyond such inflammations as have only the true adhesive progress, or where it takes place perfectly prior to suppuration.

It seems to appear from observation, that some surfaces of the body do not so readily unite by the coagulating lymph as others, and therefore on such surfaces there is commonly a much larger quantity of this matter thrown out than probably would have been if union had readily taken place; for we may suppose, that where once union has taken place, extravasation is at an end. Thus, we see in (what we may suppose) inflammation of the heart, that the coagulating lymph is thrown out on the exterior surface in vast quantities, while at the same time the heart shall not adhere to the pericardium. This is not only seen in the human, but in other animals. In an ox, the heart was furred all over, and in some places, the coagulating lymph was near an inch in thick-

ness. The external surface of such hearts has an uncommon appearance; the outer surface of the coagulating lymph is extremely irregular, appearing very much like the external surface of a sponge, while the base, or attachment to the heart, is very solid and firm. However, in many instances, we find the pericardium adhering to the heart, and generally in pretty close contact, which would make us suppose that the extent of motion of those two parts on one another is not great. These adhesions affect the pulse much, which is a good reason why nature avoids them as much as possible. On the other hand, it seems deducible from observation, that neither the pia nor dura-mater are apt to throw out much coagulating lymph, for here it would produce compression; and, therefore, we seldom find adhesions between them; in consequence of such accidents as produce suppuration between these two membranes, we seldom or ever find the surrounding parts adhering so as to confine the matter to the suppurating surface.

Inflammation of the skin, or such as approaches to the skin, produces in general a separation of the cuticle, often of the hair, or the nails. These effects arise sooner or later, according to the nature and degree of the inflammation, but more particularly according to

its nature; they take place the least and latest in the true adhesive inflammation, which is always attended with the greatest strength. In such cases, the separation does not happen till the inflammation has subsided; and as a proof of this, in the gout, it is least and latest of all; for this is always a healthy inflammation, otherwise it would not take place; but in weak habits, at the early part of the disease, there are often vesications, which are filled with serum, sometimes with coagulating lymph, etc. both of these are sometimes tinged with red blood; when the inflammation is of a weak kind, tending to mortification, the cuticle commonly separates early during the time of inflammation, almost beginning with it, and of course the vesications will be filled with serum, and often with the red globules; we may observe in wounds of the skin which are not allowed to heal by the first intention, that a separation of the cuticle will take place at the edges of the wound, and this will extend according to the nature of the inflammation, which is according to the nature of the constitution; this will be attended with other concomitant appearances, such as flabby edges and thin matter: I conceive, in the weak habit it depends on an action of the inflammation itself; but in the



strong, it depends on a state in which the parts are left to separate the cuticle.

This separation arises, I apprehend, from a degree of weakness approaching to a kind of death in the connection between the cuticle and cutis, from life being in this part naturally very weak. In the beginning of mortification it is produced; in the œdematous and erysepe-latous inflammations it is greatest, and in putrefaction of dead bodies it is the first operation. I suspect too, that a blistering plaister, hot water, etc. only kills the uniting parts, by which means an irritation is produced in the cutis, and the extravasation is according to that irritation.

The connection of the cuticle is more or less destroyed in every inflammation of the skin; for we seldom see an inflammation attack the skin, but the cuticle comes off sooner or later; we generally observe it peeling off in flakes, after inflammation has subsided, and it begins nearest the point of inflammation.<sup>s</sup>

<sup>s</sup> It may be observed, that when an inflammation attacks the finger ends, or toes, so as to produce suppuration either in the substance of these parts, although not larger than a pimple, or only on the surface of the cutis, an extensive separation of the cuticle takes place, not entirely from the inflammation, but assisted by it: this is owing, principally, to the cuticle in

VI. *Of the uniting medium in inflammations.*

EVERY new substance that is formed, is either for a salutary purpose, or it is diseased. The first consists either of granulations, or of adhesions, whether with the first, or second intention; and all these may be considered as a revival of the rational principles and powers of growth, whereas diseased substances are, as it were, monsters.

In the adhesive inflammation, the vessels being enlarged, as above described, similar to what they are in the young subject, begin to separate from the mass some portion of the coagulating lymph, with some serum, and also red globules, and throw it out on the internal surface; probably through the exhaling vessels, or perhaps, open new ones, and cover the sides of those cells, which easily unite with the opposite, with which they are in contact, forming the first progress of adhesions.

That this is really the case, and that this effect has taken place in consequence of inflammation,

such places not giving way, being there strong, so that a seeming abscess almost occupies the whole finger, etc. this should be opened early to prevent this separation as much as possible, or to prevent the separation from extending too far.

is evident from the following observations. In all large cavities, where we can make our observations with certainty, when in the state of inflammation, we find diffused over the sides, or through the cavity, a substance exactly similar to the coagulating lymph when separated from the serum, and red blood, after common bleeding. That the blood, when thrown out of the circulation from an inflammatory state of the vessels, as well as the blood itself, unites parts together, is probably best seen in the inflammation of the larger cavities abovementioned. The following I shall give as an example, which I have often observed on the peritoneum of those who have died in consequence of inflammation of this membrane. The intestines are more or less united to one another, and, according to the stage of the inflammation, this union is stronger or weaker; in some it is so strong as to admit of some force to pull them asunder;<sup>b</sup> the smooth peritoneal coat is, as it were, lost, having become cellular like cellular

<sup>b</sup> Adhesions in consequence of inflammations become very soon strong, and are very soon elongated; probably as soon as they become organized they adapt themselves to their situation, or the necessity. Thus the dog who had his belly opened to wound some lacteals, when killed on the ninth day, had his intestines connected by adhesion in several places, and those very firm and long,

membrane. When the vessels of this part are injected we shall find, that in those parts where a separation has been made by laceration, previous to the injecting, the injection will appear on that surface like small spots or drops, which shews that the vessels had at least passed to the very surface of the intestines.

In parts where the union was preserved, I have observed the three following facts. On separating the united parts, I have observed, in some places, the vessels come to the surface of the intestines, and then terminate all at once. In other places, I could observe the vessels passing from the intestine into the extravasated substance, and there ramifying, so that the vessel was plainly continued from the old into the new.

In a vast number of instances, I have observed, that in the substance of the extravasation, there were a great number of spots of red blood in it, so that it looked mottled. The same appearance was very observable on the surface of separation, between the old substance and the new, a good deal like petechial spots. How this red blood got here is the thing to be considered, especially as a good deal was within the substance of the coagulum. Was it extravasated along with the coagulating lymph? In this case I should have rather supposed it would



have been more diffused, and if not diffused, more attached to the intestine, and not in the centre of the coagulum; if it had been extravasation, one would have expected extravasation of injection, but we had none in any of these places; I have therefore suspected, that parts have the power of making vessels and red blood independent of circulation. This appears to be evidently the case with the chick in the egg.

I have observed, when I was treating of the blood, that it was capable of becoming vascular, when deposited either by accident, or for particular purposes; and I had reason to believe, that a coagulum, or coagulating lymph had a power of becoming vascular in itself, when it could be supplied with blood, and mentioned the coagulum in a large artery as an instance. Likewise, when I was treating of union by the first intention, I explained the intercourse established by the uniting medium becoming vascular, and those vessels uniting across by a process, called inosculation. The same reasoning is applicable to the union by means of the adhesive inflammation; for it is the blood in all cases that is to become vascular; but this takes place sooner or later, according to the apparent necessity. In some it becomes vascular, immediately; in others very late; and indeed, in some hardly ever, according to the

degree of utility to arise from that change. Where it becomes vascular soonest, there the vessels are found also in greatest numbers, the two effects depending on the same principle.

Extravasation, whether of blood, or only of lymph, becomes vascular, almost immediately, when thrown out into the cavity of the human uterus in the state of pregnancy. Here is an operation necessary to go on, which is more than the simple support of the extravasation itself; but when the extravasation is thrown out by accident, or for the purpose of producing adhesions, the immediate intent is answered without the vessels, and vascularity only becomes necessary afterwards; therefore vascularity in such cases is the second consideration, not an immediate one. But in the case of impregnation it must be immediate, for the simple extravasation would not answer the intention. This shews that this extravasation is very different from that of the menses.

The new vessels which are formed in the newly extravasating and uniting substance, become of use both during the state of adhesion and suppuration.

In the first, they serve to give powers of action to this new substance, which assists in preventing suppuration. In the second, where

this cannot be done, they assist in forming a vascular basis for the granulations.

When we cut into inflamed parts after death, we find them firm and solid, resembling the section of a lemon, or some œdematous tumor, where we know extravasation has taken place.

This appearance arises from the cells in the cellular membrane, and other interstices of parts, being loaded with extravasated coagulating lymph; from this circumstance they are cemented together and become impervious to air, not similar in these respects to common cellular membrane, or natural parts. In many places where this extravasation has been in considerable quantities, it is formed in time into cellular membrane.

I have observed, that this mode of the separation of coagulating lymph is not peculiar to inflammation; it is separated in many diseases.

It is thrown out to form tumors, etc. where inflammation does not seem to be a leading cause; and we often find the adhesive stages, as it were, degenerate into, or terminate in the formation of a cyst, to contain the body that was the cause of the inflammation. Thus a sack is formed for bullets, pieces of glass, etc.

It is unnecessary to instance every possible situation where adhesions could be produced;

they can take place wherever there are two internal surfaces in contact, or that can be brought into contact. I cannot give a better instance of its utility in the animal œconomy, than in the following experiment: I wished to know in wounds which penetrated into the chest, (many of which I have seen in the army) where suppuration had come on the whole cavity of the chest, as well as on the surface of the lungs, and where the lungs collapsed, how parts were reinstated, or in what form they healed; whether the lungs, etc. lost their suppurating disposition, and dilated, so as to fill the chest again. To ascertain this as far as one well could, I made the following experiment on a dog.

October, 1777, I made an opening between the ribs into the chest of a dog, and touched the edges of the wound all round with caustic to prevent it from healing by the first intention, and then allowed the dog to do as he pleased. The air at first passed in and out of his chest by the wound. He eat, etc. for some days, but his appetite gradually began to fall off. He breathed with difficulty, which increased; he lay principally on that side, which we find people do who have the lungs diseased in one side only or principally; and he died the eleventh day after the opening. On opening the body, I



found the collapsed lungs passing directly across the chest, and attached to the inside of the wound all round, so that they excluded the cavity of the chest from all external communication. This circumstance of the lungs falling across the chest, was owing to his having lain principally on that side, which I conceived to have been only accidental.

The cavity of the chest all round was filled with air. That part of the external surface of the lungs which did not adhere, that is to say, the upper surface of the diaphragm, and that part of the pleura which covered the ribs were entirely free from inflammation or suppuration; this cavity, from these adhesions, being rendered a perfect cavity, shews that air, simply, has no power to excite inflammation when the cavity is otherwise perfect, which the adhesions had effected; this shews also that adhesions of two surfaces round the exposed part, exclude every part from the necessity of inflammation, as was explained when treating of inflammation.

From the connection between the living powers of the solids and the fluids, we can hardly suppose that such an uncommon action could take place in the vascular system, without producing its effects upon the fluids; and therefore, from reasoning, we might suppose, that the coagulating lymph undergoes some

changes in its passage through the inflamed vessels, which obliges it to coagulate more immediately, or much sooner than it otherwise would.<sup>1</sup>

For in those cases of inflamed arms, after bleeding, and in inflammations in consequence of other causes, we find that the cavities of the veins are in many places furred over, and in others united by means of the coagulating lymph. Now if this coagulating lymph is similar in its productions to that which we have been describing, it must have been thrown out from the vasa vasorum, these vessels having separated it and poured it into the cavity of the veins, and it must there have coagulated immediately; in this separation, therefore, from the blood, it must have undergone some change, arising from the actions of the vessels; for if this lymph was no more than the coagulating lymph with its common properties, or the properties common to that which is circulating in the same vein which receives it, it would in such cases only continue

This is contrary to the disposition of inflammatory blood when taken out of the vessels and allowed to go through its spontaneous changes; from which it would appear that the general affection of the blood (which I would call sympathy of the coagulating lymph with the universal irritation) is different from its affection or disposition when employed for the purposes of union.

to throw in more coagulating lymph, in addition to what was circulating, and therefore, probably, it would be carried along with the blood to the heart, as a part of the common mass. From this we should infer, that this coagulating matter is not simply the coagulating lymph, such as it is when circulating, but somewhat different, from having undergone a change in its passage through the inflamed vessels, partaking of the disposition of those solids which are inflamed, through which it passed. This process cannot, therefore, be supposed to be merely extravasation; for I conceive that an oedema would be a consequence of simple extravasation. But this may be taken up in another point of view, and upon the same principle. The inflamed vessels may give a disposition to the blood, as it is moving slowly along, to coagulate on its surface; and, this is, probably, the more just idea of the two; as we find that the vessels, both veins and arteries, can give this disposition, and to a very great extent: we find in the beginning of mortification, the blood coagulating in the vessels, so as to fill them up entirely, and this preceding the mortification, seems to be for the purpose of securing the vessel before it is to give way; we, therefore, cannot doubt of a coagulating principle being given to the blood from the vessels; and as a

further proof of this, we may observe that the extravasated coagulating lymph, which produces either adhesions or forms tumors, (which is often the case) is always of the nature of the diseased solids that produced it. If the case is venereal, the new substance is of the same nature; if cancerous, it is cancerous; for I find that it has, when absorbed, the power of contaminating, similar to matter or pus produced by the sores or ulcers of such diseases; the absorbent glands being often affected by the absorption of the coagulating matter of a schirrous breast.

Whatever change the coagulating lymph has undergone in this operation of inflammation, it seems so far the same, as to retain still the nature of the coagulating lymph, and to possess the living principle; this is most probably in a greater degree, and therefore, the coagulating lymph is still better fitted to be formed into a part of the solids of the body, as will be taken notice of when we come to treat of the state of the blood in inflammation.

But it is not absolutely necessary that the coagulating lymph should first undergo a change in the extravasated vessels, before it can become a living solid, or unite living solids; for we find that common blood extravasated from a ruptured vessel is, perhaps, equally efficacious in



this respect; therefore the red globules do not retard union, but they may promote it.

VII. *The state of the blood, and of the pulse, in inflammation.*

FROM what has been said of the living power of the blood, I think we must allow that it will be commonly affected much in the same manner with the constitution, and that disease will have nearly the same effect upon it, as it has on the body; because, the same living principle runs through the whole. We find this to be nearly the case; for till a disease has affected the constitution, the blood continues the same as before; but as the constitution becomes affected, the blood also becomes affected, and undergoes the same changes, which, probably, may be ascribed to contiguous sympathy between the vessels and the blood; and we shall find that the changes in the blood are often as much expressive of disease as any other part of the body. It is expressive of strong action, as well as of weak action; but as it does not give sensation, it cannot convey to the mind all the varieties of disease that may take place in it; yet I could conceive, if the blood was to be

primarily affected, that an impression would be made upon the mind, from its affecting the vessels in which it moved. However it is not always the case that the state of the blood and the other symptoms are expressive exactly of the same thing; the blood often expressing less, and often more; when the action of the solids is of the inflammatory kind, or which, perhaps, is the same thing, when there is too great an action of the solids, the blood more readily admits of a separation of its visible parts, and the coagulating lymph coagulates more slowly, but becomes firmer when coagulated; this last circumstance, however, might be supposed not to be so clear, for, its firmness may be owing to its want of the red particles, which certainly give the blood a brittleness in proportion to their quantity; but although this may have some effect, yet it is very little; for we find blood of loose texture in some inflammations, when deprived of its red part; when blood has this disposition it is called *sizy* blood. These changes in the nature of the blood depend so much upon the above-mentioned causes of inflammation, that it is impossible to say whether they do not constitute the first universal effect produced from the local inflammation, and whether the constitutional is an effect of this change in the blood. I knew a man who was stabbed in the

loins, and, according to the consequent symptoms, was most probably wounded or hurt in some viscus within the abdomen. At first he had no symptoms, but simple pain in the part, I therefore only bled him, by way of precaution, and the blood was perfectly natural; in less than a quarter of an hour after, constitutional symptoms came on, such as rigor, sickness, etc. and on opening the same orifice, and taking away more blood, this second quantity had a very thick and strong buff upon it, having all the appearance of inflammatory blood; while this constitutional disposition lasted, which was some time, his blood continued the same, which was proved by the subsequent bleedings. The subsiding, however, of the red globules in the blood when in an inflamed state, although pretty frequent, is not always an attendant, or in other words (and perhaps upon some other principle) the blood is not always attended with this appearance, when the visible symptoms are the same. A young woman was attacked with a violent cough, oppression in breathing, quick, full, and hard pulse. She was bled, which gave her ease; the blood was sizzly; the symptoms again returned, and she was bled a second time; which also relieved her, and the blood was more sizzly than before: so far all the symptoms agreed. The symptoms again recurred and were

more violent than before; she was bled a third time, and a third time relieved; but this blood was not in the least sizzly, although it came from the vein very freely. Here then, the blood, under the same disease, lost this disposition, although the symptoms remained the same. As inflamed blood leaves a portion of the coagulating lymph free from the red globules at the top, and as that can be accounted for upon the principle of the coagulating lymph, in such cases not coagulating so fast as when the blood has not this appearance, and as the coagulation hinders any comparative experiment respecting the weight of the red globules of each, I tried to see if they sunk in serum faster in the one kind of blood than in the other; I took the serum of inflammatory blood, with some of the red part, and also some serum of blood free from inflammation, with nearly the same quantity of the red part; they were put into phials of the same size; I shook them at the same time, then allowed them to stand quiet, and observed that the red globules subsided much faster in the inflammatory blood than in the other. To ascertain whether this arose from the red globules being heavier, or the serum lighter, I poured off the serum from each, as free from red blood as possible, then put the red part of the one into the serum of the other, and shook them to mix them



well; and, upon letting them stand quiet, the red globules appeared to fall equally fast. From these experiments it appears, that the red part of inflammatory blood was heavier than that which is not so, and the serum was lighter, and the difference pretty nearly equal; for if we could suppose that the red globules were one tenth heavier, and the serum one-tenth lighter, then the difference in the subsiding of the red globules of inflammatory blood in its own serum, to that which is not inflammatory, would be as one to five; and if they were to be changed, then they would be equal. To see whether the blood from an inflamed part was different from that drawn from a part not inflamed, the following experiments were made:

A large leech was applied to an inflamed surface, and when it had sucked itself full, another leech was suffered to fill itself from the breast where no inflammation existed; they were both cut in two, and the blood received in two tea-cups, kept moderately warm in a dish of warm water; both of them coagulated without the serum separating; but the inflamed blood was evidently of a lighter colour than the blood from the uninflamed part; but neither had the appearance of a buffy coat.

Whether the disposition for inflammation,

and the change produced in the blood, arise from a real increase of animal life, or whether it is only an increase of a disposition to act with the full powers which the machine is already in possession of, is not easily determined; but it appears to be certain, that it is either the one or the other: there are some circumstances, however, that would incline us to suspect it to be the latter, because there is often inflammation when the powers of the machine are but weak, where it appears to be only an exertion of very weak powers, arising from some irritation produced; in such cases the blood will shew signs of weakness although sily.

This appears to be equally the case in local inflammation, and inflammatory fevers, or in the symptomatic fever.<sup>k</sup> That it is an increase

<sup>k</sup> On the other hand it would appear reasonable to suppose, that there was really an increase of animal life, for women who are breeding, and are in perfect health, always have sily blood; and this is most remarkably the case with all animals in similar situations; now it would appear necessary for an animal, whenever put into a situation where greater powers are wanted, to have these powers increased. In a breeding woman there is a process going on, though natural yet uncommon, and which requires a greater exertion, or a greater quantity of powers than usual, and therefore we have them produced. This process of breeding, although in many of its symptoms it is similar to fever, is yet very different; for actual fever kept up for nine months, would destroy the per-

of the one or the other, and that the sensible effect produced arises from the action taking place, both in the solids and fluids, is proved by the method of treatment, which will be further illustrated in speaking of the mode of cure: on the other hand, where there is great debility in the solids, where the powers of preservation (the first animal powers) are weak, therefore the action weak, and where of course the body must have a tendency to dissolution, there we find the very reverse of the former appearance in the blood. Instead of separating distinctly and coagulating firmly, we have the whole mass of blood keeping mixed, and hardly any coagulation, only becoming of a thicker consistence.

This effect, or appearance, often takes place in those who die instantaneously. I suspect that in such cases the blood dies first, and also instantaneously.

In the commencement of most diseases, and even through the whole course of many, the situation of the blood appears to be an object with nature. In some the blood forsakes the skin

son, while on the other hand, many are relieved by such a process.

If these observations are just, this blood should not be called inflammatory blood, but blood whose powers of life are increased.

and extremities, and we may suppose the smaller vessels in general; for when we can observe internal parts, so we find it, such as the mouth in general, eyes, etc. a general paleness takes place, which is best seen in the lips, and even a shrinking of the external visible parts takes place, especially the eyes, so that the person looks ill, and often looks as if dying. The pulse is at this time small, which shows that the whole arterial system is in action.

This appears to arise from debility, or the want of powers in the constitution to be acted on by such a disposition at the time, so that the whole powers or materials of life are called into the vital parts or citadel, and the out-works are left to themselves. Such is the case with fainting; the cold fit of an ague; the cold fit or beginning of a fever; rigors or beginnings of exacerbations; it is also the case with the hectic.

In the commencement of diseases it does not appear to arise from real debility of constitution, but the novelty of the action, and of course a debility in that action, and in that only; but in the hectic, where a real debility has taken place, those appearances are owing to that cause; however, even in the hectic, this debility is assisted by the unnaturalness of the action.



In the first, where there are real powers, it would appear as if nature was struggling with the new disposition, and it either becomes destroyed entirely or in part, and the blood is then determined to the skin; and we may suppose into the smaller vessels in general; then the pulse becomes full; the whole action now appears to be there, and it becomes hot; when that action in the skin ceases, a perspiration takes place, and nature seems in many cases to be at rest; in some disorders this cessation is perfect for a time, as in agues; sometimes wholly, as in slight colds; but often imperfectly, as in continued fevers, where the cessation appears only to arise from weariness, which prevents the continuance of the action, not from an alteration of the disposition.

In other diseases the blood is thrown very early upon the exterior parts. The face shall look bloated, the eyes full, the skin red, dry, and hard to the touch.

These symptoms, I suspect, belong more to fevers of the putrid kind, and have less connection with surgery than the former.

The pulse is often as strong a sign of the state of the constitution as any other action that takes place in it, though it is not so always; but as the pulse has but one circumstance attending

it, that we can really measure, all the others being referrable to the sensation or feeling of the person who is to judge of it, the true state of the pulse is not easily ascertained. The knowledge of the soft, the hard, and the thrill, are such as can only be acquired with accuracy by the habit of feeling pulses in these different states, and by many is not to be attained; for simple sensation in the minds of any two men is seldom alike. Thus, we find, it happens with respect to music; for what would be disagreeable and not in harmony to one ear, which is nice, and accustomed to the harmony of sounds, will not be so to another.

The late Dr. Hunter was a striking instance of this; for though he was extremely accurate in most things, he could never feel that nice distinction in the pulse that many others did, and was ready to suspect more nicety of discrimination than can really be found. Frequency of pulsation in a given time is measurable by instruments; smartness or quickness in the stroke, with a pause, is measurable by the touch; but the nicer peculiarities in the pulse are only sensations in the mind, I think I have been certain of the pulse having a disagreeable jar in it, when others did not perceive it, when they were only sensible of its frequency and strength; and it is perhaps this jar

that is the specific distinction between constitutional disease or irritation and health; frequency of pulsation may often arise from stimulus, but the stroke will then be soft; yet softness is not to be depended on as a mark of health, it is often a sign of dissolution; but then there must be other attending symptoms.

In the consideration of the peculiarities of the pulse, it is always necessary to observe, that there are two powers acting to produce them, the heart and the arteries; that one part of the pulse belongs to the heart alone, another to the arteries alone, and the third is a compound of both; but the actions of the heart and arteries do not always correspond; the heart may be in a state of irritation, and act quickly in its systole, while the arteries may be acting slowly; for the heart is to be considered as a local part, while the vessels must be considered as universal, or even constitutional. The stroke, (which is the pulse) with the number of them that are made in a given time, whence the pulse is commonly called quick or slow, their regularity and irregularity as to time, and the quickness of the stroke itself, belongs to the heart. The quickness of the heart's action often takes place, although the pulsations are not frequent, which gives a kind of rest or halt to the artery or pulse, especially if the pulse be not frequent.

The hardness, the vibratory thrill, the slowness of the systole, with the fulness and smallness of the pulse belong to the arteries. As the pulse arises from the actions of the solids or machine, its state will be of course according to the nature of the machine at the time, and therefore is capable of being in one of these states, natural and diseased.

In most diseases of the constitution, whether originating from it, or arising in consequence of diseases of parts, where the constitution becomes affected by sympathy, the pulse is altered from a natural to a diseased state, the degree of which will be regulated by those affections. This alteration is commonly so constant, and so regularly of the nature of the disease, that it is one of the first modes of intelligence we have recourse to, in our inquiries into its nature; but alone it is not always a certain guide; for where there are peculiarities of constitution, we find the pulse corresponding to those peculiarities, and, perhaps, in direct contradiction to the accustomed state of the local affection. The same parts too, under disease, give very irregular, or uncertain signs in the actions of the heart and vessels, such as diseases or injuries done to the brain.

The varieties which the pulse admits of are



several. It is increased in its number of strokes, or it is diminished. It is regular or irregular, as to time in its stroke; it is quick in its stroke, or diastole, and slow in its systole. It is hard in its diastole, and it vibrates in its diastole.

In most cases, probably where the constitution is in a state of irritation, the pulse will be quick and frequent in its number of strokes in a given time, and the artery will become hard from a constant, or spasmodic contraction of its muscular coats, so as to give the feel of hardness to the touch; besides which the diastole of the artery is not regularly uniform and smooth, but proceeds by a vast number of stops or interruptions, which are so quick as to give the feel of a vibration, or what we would express, by a thrill.

The pulse under such a disposition, or mode of action, may be either full, or small.

These two very opposite effects do not seem to arise from a difference in the quantity of blood, which might at first be supposed; I should rather suspect that they arise from a difference in the degrees of strength, which will be more or less, according to the nature of the parts inflamed, and the degree of irritability of the patient at the time. These give, more or less, an anti-diastolic disposition to the arteries; and

while the arteries have the power of contraction, and are in a state of irritation, this effect will always take place.

It is certain at least, that the arteries do not commonly, in such a state of constitution, dilate so freely and so fully as at other times, and as this will vary very quickly, (if the constitutional irritation varies quickly) it is more reasonable to suppose, that it is an immediate effect of the arteries, than an increase, and decrease of the quantity of blood.

If this be really the case, then we should naturally suppose that the motion of the blood in the arteries would be increased in proportion to their diminished size; except we should also suppose, that the diastole, or the systole, or contraction of the heart, is also diminished in the same proportion. The first of these, I think, may probably be the case, as we find that the blood forsakes the surface of the body in such a state of the constitution, as will hereafter be observed, therefore must be collected in the larger veins about the heart.

If the heart was to dilate and throw out its whole contents at each systole, then the velocity of the blood, in the arteries, under such a state of contraction of arteries, would be immense, and it might then be pushed into the

smaller vessels on the surface of the body, which it certainly is not.

The quick, hard, and vibratory pulse is generally an attendant upon inflammations; and whether it be attended with fulness, or the contrary, depends a good deal upon the part that is inflamed, which either increases, or decreases the irritability, which will be described in treating of the different parts inflamed.

In such a state of the constitution, as produces such a pulse, the blood, which appears to be only a passive body, acted upon by the heart, so as to produce the diastole of the artery, and reacted on by the vessels, making the complete pulse, this blood, I say, is generally found in a different state from that where there are not these symptoms in the pulse; they, as it were, constantly attend each other, or are the reciprocal cause and effects of one another, as was taken notice of when I was speaking of the state of the blood in inflammation.

From the account I then gave of the state of the blood in inflammation, and have now given of the pulse, under the same action, it should naturally be expected, that they should explain each other; which for the first part they certainly do; yet these appearances of the blood, and the kind of pulse, are every now and then

appearing to be in opposition to each other, in their common attending circumstances; but this cannot be known till the person is bled; when the pulse is quick and hard, with a kind of vibration in the action, we generally have sizy blood. This may arise from fever, or such inflammation, etc. as affects the constitution, or vital parts, these being so diseased as to keep up a constitutional irritation, which will always be an attending symptom; but when we have neither a quick nor a hard pulse, both perhaps below par, and rather small, no visible fever, nor inflammation, but, probably, some strong, undetermined symptoms, such as pain, which is moveable, being sometimes in one place, sometimes in another, but at the same time seeming to impede no natural function, yet upon bleeding, the blood shall be sizy, and the size shall have strong powers of contraction, so as to cup.

A gentleman was ill with a pain, chiefly in his right side; but upon the part being rubbed, or application being made to it, the pain seemed to move to some other part; from which circumstance it was supposed to have connection with the bowels; at other times he was tolerably well. His pulse was slow, small, and soft, and not at all to the feel, like a pulse which required bleeding. He desired to be bled, and when bled, the blood was extremely sizy; the



size being strong, and contracting so much as to draw in the edges, forming the upper surface into a hollow, or cup. His pulse became fuller, quicker, and harder; he was bled a second time; the blood was the same, and the above symptoms increased so much, that I observed, immediately after the second bleeding, his pulse was quicker, harder, and fuller, than it was just before the bleeding. That it might be quicker and fuller, I could conceive, because I have often seen such effect from bleeding, where there had been an oppressed and languid pulse; but I cannot say that I ever saw a case where the pulse became harder, and acquired the vibration, except when debility or languor was produced, and where the blood was weak in its powers of coagulation, being flat on the coagulated surface. Another want of correspondence, or irregularity, takes place when a constitution sympathizes with a local inflammation. There are cases where the pulse becomes slow, and often irregular; such are mostly to be found in all people, when the constitution is affected originally or sympathetically, and in such, I suspect that a disposition for dissolution, and perhaps mortification, is much to be feared.

A man, aged sixty-eight years, had an occasional inflammation in one of his legs, which often ulcerated, and which seemed to arise more

from a defect in the constitution than to be simply local. In those indispositions, his pulse seldom exceeded forty in the minute, and as he began to get better, his pulse became more and frequent.

The varieties of the pulse arising from the seat of the inflammation, and the nature of the part inflamed, will be expressed when I treat on inflammations in different situations and parts.

VIII. *The effects of inflammation on the constitution, according to the structure of parts, situation of similar structures, and whether vital or not vital.*

THESE circumstances make a very material difference in the effects on the constitution, arising from local inflammation; for we shall find that the effects on the constitution are not simply as the quantity of inflammation, but according to the quantity and parts combined, (supposing constitutions to be equal) which I shall now consider separately.

In common parts, as muscle, cellular membrane, skin, etc. the symptoms will be acute, the pulse strong and full, and the more so, if it be felt near the heart; but perhaps not so quick as when the part is far from it; since there will be less irritability. The stomach will sympathize

less, and the blood will be pushed further into the smaller vessels.

If the inflammation is in tendinous, ligamentous, or bony parts, the symptoms will be less acute, the stomach will sympathize more, the pulse will not be so full, but perhaps quicker, because there will be more irritability, and the blood will not be so much pushed into the smaller vessels, and therefore forsakes the skin more.

It seems to be a material circumstance, whether the inflammation is in the lower or upper extremity; that is, far from, or near to the heart; for the symptoms are the more violent, the constitution is more affected, and the power of resolution seems to be less, when the part inflamed is far from the source of the circulation, than when near it, even when parts are similar, both in texture and use.

Whatever course the inflammation is to run, or in whatever way it is to terminate, it is done with more ease when near to the heart than when far off.

All the parts that may in one sense be called vital, do not produce the same effects upon the constitution; and the difference seems to arise from the difference in their connections with the

stomach. It is to be observed, that vital parts may be divided into two, one of which is in itself immediately connected with life, as the stomach; the other where life only depends upon it in its action or use; the heart, lungs, and brain are only to be considered in this last light; therefore they have a considerable sympathizing affection with the stomach; the symptoms are rather depressing; the pulse is quick, small, and the blood is not pushed into the smaller vessels.

If the heart or lungs are inflamed, either immediately, or affected secondarily, as by sympathy, the disease has more violent effects upon the constitution than the same quantity of inflammation would have, if it was not in a vital part, or was in one with which the vital parts did not sympathize; for if it is such as the vital parts sympathize with readily, then the sympathetic action of the vital parts will affect the constitution, as in an inflammation of the testicle.

The pulse in such cases, is much quicker and smaller than when in a common part, as a muscle, cellular membrane, or skin; but not so much so as in the stomach, and the blood is more sizzly. When the inflammation is in the heart only, its actions are extremely agitated and irregular. If



in the lungs, singly, the heart in such cases would appear to sympathize, and not allow of a full or free diastole.

The stomach does not in common sympathize in such cases, which is the reason, perhaps, of the inflammation not depressing; but it is to be observed, that I make a material difference between the inflammation of the lungs, commonly called a pleurisy, and those diseases that begin slowly, and spin out to great lengths, and which are truly scrophulous, producing the hectic; for in them we have the hectic pulse, and not the inflammatory.

If the stomach is inflamed, the patient feels an oppression and dejection through all the stages of the inflammation; simple animal life seems to be hurt and lessened, just as sensation is lessened when the brain is injured; the pulse is generally low and quick, the pain is obtuse, strong, and oppressing, such as a patient can hardly bear.

If the intestines are much affected, the same symptoms take place, especially if the inflammation be in the upper part of the canal; but if it is the colon only which is affected, the patient is more roused, and the pulse is fuller than when the stomach only is inflamed.

If it be the uterus, the pulse is extremely

quick and low. If it be a testicle that is inflamed, the pain is depressing, the pulse is quick, but not strong.

When the inflammation is either in the intestines, testicle, or uterus, the stomach generally sympathizes with them, which will produce or increase the symptoms peculiar to the stomach. In inflammation of the brain, I believe the pulse varies more than in inflammations of any other part; and, perhaps, we are led to judge of inflammation there, more from other symptoms than the pulse. I believe the pulse is sometimes quick, slow, depressed, full, etc. and which may accord with the other symptoms, such as delirium, stupor, etc.

It is to be observed, when the attack upon these organs, which are principally connected with life, proves fatal, that the effects of the inflammation upon the constitution run through all the stages with more rapidity than when it happens in other parts; so that, at its very beginning, it has the same effect upon the constitution, which is only produced by the second stage of fatal inflammation in other parts. Debility begins very early, because the inflammation itself is interfering immediately with the actions of life; and also in such parts universal sympathy takes place more readily, because the connection of these parts by sympathy is more

immediate; and if the sympathy is similar to the action, then the whole is, in some degree, the same action.

If the inflammation comes on in a part not very essential to life, and with such violence as to affect the actions of life, or to produce universal sympathy, the pulse is fuller and stronger than common; the blood is pushed further into the extreme arteries than when the inflammation is in a vital part; the patient, after many occasional rigors, is at first rather roused, because the actions of the part are roused; and the effects in the constitution are such as do not impede any of the operations of the vital parts. It is allowed to proceed to greater lengths, or greater violence in itself, before the constitution becomes equally hurt by it; and the constitutional symptoms produced at last, may be said to arise simply from the violence of the inflammation; but this will take place, more or less, according to circumstances; it will be according to the nature of the parts, whether active as muscles, or inactive as tendons; also according to the situation of the same kind of parts, as well as according to the nature of the constitution. If the constitution is strong, and not irritable, the pulse will be as above; but if the constitution is extremely irritable and weak, as

in many women who live sedentary lives, the pulse may be quick, hard, and small, at the commencement of the inflammation, similar to the inflammation of vital parts. The blood may be sizy, but will be loose and flat on the surface.

IX. *General Reflections on the resolution of inflammation.*

I NOW come to the most difficult part of the subject; for it is much more easy to describe actions, than to assign motives; and without being able to assign motives, it is impossible to know when or how we may or should check actions or remove them. I have endeavoured to shew that an animal body is susceptible of impression, producing action: that the action, in quantity, is in the compound ratio of the impression, the susceptibility of the part, and the powers of action of the part or whole; and in quality, that it is according to the nature of the impressing power and the parts affected. I have also endeavoured to shew that impressions are capable of producing or increasing natural actions, and are then called stimuli: but that they are likewise capable of producing too much action, as well as depraved, unnatural, or what are commonly called diseased actions. The



first of these I have mentioned by the general term, irritations: the depraved, etc. come in more properly in treating of peculiar, or specific actions.

Since then an animal body can be made to increase its natural action, or to act improperly by impression, so we can see no reason, when it is acting too violently, why it should not be restrained by impression; or when acting improperly, in consequence of these impressions, why it should not be made to act properly again by the same mode, namely, by impressions.

These modes of action we are first to understand, and then the power of correcting, or counteracting those impressions, in order to diminish or prevent the action, so as to produce one that is healthy or natural; besides an injury which produces a new mode of action, and a disease, which is a new mode of action, often happen when the machine is in perfect health, and in such a state as is perfectly in harmony with that health; but which state is not suitable to disease; therefore, it is to be presumed, the more perfect health the body enjoys, the less it bears a change in its actions. Thus we know that strong health does not bear considerable injuries, such as accidents, operations, etc. A man in strong health, for instance, will not bear

a compound fracture in the leg, or an amputation of the same, so well as a man accustomed to such diseases, and reduced by them. We find commonly, that our artificial mode of reduction, is by far too quick, and is almost as much a violence on the constitution as the injury; when, therefore, considerable injuries or diseases commence, the constitution is to be brought to that state which accords best with that accident, or disease. The knowledge of that state of the body at that time, as well as the operations of the whole animal, or of its parts, when arising from a disturbed or deranged state, or a diseased disposition, are to be considered as the first steps towards a rational cure: but this alone is insufficient; the means of bringing the body to that state are also necessary, which will include the knowledge of certain causes and effects, acquired by experience, including the application of many substances, called medicines, which have the power of counteracting the action of disease: or of substances perfectly inefficient in themselves, but capable, under certain circumstances, of producing considerable effects, such as water when hot and cold; or a substance when it varies its form, as from fluidity to vapour. Of these virtues we know nothing definitely; all we know is, that some are capable of altering the mode of action, others

stimulating, many counter-stimulating: some even irritating, and others quieting, so as to produce either a healthy disposition, and action in a diseased part, or to change the disease to that action which accords with the medicine, or to quiet where there is too much action; and our reasoning goes no further than to make a proper application of those substances, with these virtues. The difficulty is to ascertain the connexion of substance and virtue, and to apply this in restraining or altering any diseased action; and as that cannot be demonstrated *à priori*, it reduces the practice of medicine to experiment; and this not built upon well-determined data, but upon experience, resulting from probable data. This is not equally the case through the whole practice of medicine, for in many cases we are much more certain of a cure than in others; but still, even in them, the certainty does not arise from reasoning upon any more fixed data, than in others, where the certainty of a cure is less; but it arises from a greater experience alone; it is still no more than inferring that in what is now to be tried, there is a probable effect or good to arise in the experiment, from what has been found serviceable in similar cases: diseases, however, of the same specific nature, not only vary in their visible symptoms or actions, but in many

of those that are invisible, arising probably from peculiarities of constitution and causes, which will make the effects of applications vary, probably almost in the same proportion; and as those varieties may not be known, so as either to adapt the specific medicine to them, or to suit the disease to the medicine, it will then be only given upon a general principle, which of course may not correspond to the peculiarities. Even in well-marked specific diseases, where there is a specific remedy, we find that there are often peculiarities, which counteract the simple specific medicine. This we even see in poisons, the most simple specific of all, because its effect arises in all cases from one cause; the peculiarities, therefore, in the disease must arise from a peculiarity in the constitution, and not from the cause of the disease.

The inflammation I have been treating of is the most simple of any, because it is the simple action of the parts unmixed with any specific quality, arising from causes of no specific kind, and attacking constitutions and parts not necessarily having any specific tendency; the cure, therefore, or method of terminating the inflammation, which is called resolution, (in cases that will admit of it) must also be very simple, if we knew it; and accordingly, when the cure of such is known, it lays the founda-



tion of the general plan for the treatment of all inflammations of the same kind: but it very rarely happens that a constitution is perfectly free from a tendency to some disease;<sup>1</sup> we seldom, therefore, see simple salutary actions of parts tending to relieve themselves from a violence committed: some constitutions being so irritable, that the inflammation has no disposition to terminate, and others so indolent that the inflammation passes into another species, as into scrophula; all of which will require very different treatment.

The same varieties take place in specific inflammations; as also in inflammations arising from poisons; for many will have the true inflammatory disposition joined with the specific; in such, therefore, the same plan is to be pursued, with the addition only of the specific treatment; but this must not be omitted, as the inflammation depends upon the specific disease. It is this critical knowledge, which becomes the basis of practice; and it is this which requires the greatest sagacity; and I must own, it requires more knowledge than comes to the share of most practitioners. As every inflammation has a cause, that cause should be removed be-

<sup>1</sup> Vide the varieties of the inflammation, in the introduction.

fore resolution can take place; for the animal œconomy having a disposition within itself to discontinue diseased action, that of course subsides upon the removal of the cause; and this disposition is so strong in some, as to appear to act alone. That removing the cause is a mode of resolution, is proved in the venereal bubo; for by taking off the venereal action with mercury, the inflammation subsides, if another mode of action does not arise.<sup>m</sup> Inflammation, where it must suppurate, is most probably a restorative act, and cannot be resolved in those cases where restoration becomes necessary; as, for instance, in a wound that is kept exposed, the inflammatory act of restoration becomes, or is rendered necessary, and it takes place; but bring those parts together, or let the blood coagulate and dry upon it, and it becomes unnecessary. I have already observed, when treating of the causes of inflammation, which might be called the spontaneous, that they probably arose from a state of parts, in which they could not exist, similar to exposed surfaces, and therefore this act of restoration became necessary: if this be true, then probably by altering that state of parts, as we can by bringing the divided parts together, the inflammation

<sup>m</sup> Vide Treatise on Venereal Disease.

would either not rise, or immediately cease; but as we are not in all cases acquainted with the mode of restoring those natural actions, we are obliged to be restricted to those methods that render them easier under this state, and which are often capable of turning the balance in favour of resolution.

As inflamed parts are not always visible, it becomes necessary that we should have some rule to inform us, whether the part is inflamed or not; to ascertain which, we much have recourse to all the symptoms formerly mentioned, except the visible ones. We ought also to have a guide respecting the kind of inflammation, more especially as it is not sufficient, in many cases, to be guided entirely by the appearances, even where it is in sight; it is often, therefore, very necessary to inquire into the cause of the inflammation, the nature of the constitution, the effects that former inflammation has produced, and even into the temper and mind of the patient.

The cure of inflammation is resolution; and the attempt towards it is principally to be made when the inflammation is in the adhesive state; for we find that often it goes no further, but subsides, and this is resolution; probably the sooner after its commencement it is the better. The object of the attempt is to

prevent suppuration taking place, although suppuration may be considered as a resolution, but it is the mode of resolution we commonly wish to avoid. Resolution is in general only to be attempted, with any probability of success, under the following circumstances: when the inflammation is in consequence of the constitution, or a disease of the part: secondly, in cases of accident, where there is either no exposure, or where it has been removed in time: as, for example, by bringing the parts in contact: thirdly, where the life of the part has not been destroyed. In all such cases we find that resolution can take place; but in those cases arising from accident, and a continuance of exposure joined, or where death of the parts is produced by the accident, it becomes impossible to hinder the suppuration from taking place.

I have already observed that in many bruises, as well as simple fractures, where the cavities are not exposed, and where they are to heal by the first and second intention, the inflammation, in most of these cases, is capable of being resolved; although, in some such cases, the inflammation runs so high as to threaten suppuration. I have also already shewn, that in parts which have been divided and exposed, the inflammation is, by bringing them together, in a great measure prevented; or if it has taken



place previous to the union, that the same operation of union is sufficient to produce resolution; and I have likewise shewn that where parts were not brought together, nature attempted to prevent inflammation, by covering the wound with blood, and forming an eschar, which, in many cases, will either prevent or remove inflammation; all of which shews a power of resolution, even in the cases where the parts have been exposed.

*In what cases  
resolution  
should not  
be attempted.*

As it is commonly supposed that there are a great many local diseases that should not be resolved, the first thing necessary to be considered, is, when the resolution should or should not be attempted. On the contrary, there are cases where inflammation is to be excited, but these arise commonly from disease, which is not to our present purpose; yet it sometimes happens in accidents, where inflammation is necessary, that it is not sufficient for the reinstatement of the injured parts, as in some simple fractures, where the first bond of union, the extravasated blood, had not fulfilled its purpose, and had been absorbed, and where the inflammation was too slight to supply its place; so that union of parts was prevented, and another mode became necessary, not at all a consequence of inflammation, viz. granulations without suppuration; all of which retards still more

the restoration of the parts. As this defect can only be known in bone, and in the soft union of the bone, which is similar to the union in the soft parts, it is reasonable to suppose, it may also take place in the soft parts; more especially those which are tendinous, or ligamentous, where we find recovery very slow, for the soft union in bones differs in nothing from that of the soft parts; it may, therefore, be a much more common defect than is generally imagined. In such cases, if it could be known, it would be proper to encourage, or even excite inflammation. If we cannot, probably, in any case determine where it should be excited, nor even where it should be checked, yet we can say, in many cases, where it is unnecessary to check it. Before we attempt to check inflammation, we should have reason to suppose it is going further than is necessary for the natural cure; and therefore it is laying the foundation of work for the surgeon. It may be very difficult to say, in many cases, when it should be checked. The most simple reason will be to lessen pain, arising in a part not merely when moved or touched, but in the act of inflammation. Secondly, where it may be uniting parts, the union of which we wish to avoid; but this is an uncertain guide, even if we knew adhesions were taking place, for adhesions often pre-

vent suppuration. Thirdly, to prevent the inflammation from suppurating; and in this last, although the most obvious, yet there is less certainty how far we may advise the attempt. It is also the most difficult to effect; for in many cases of spontaneous inflammation, if it arises from a state under which the parts cannot exist, nor their functions go on, similar to an exposed breach in the solids, then resolution should not be attempted: it may be palliated when going beyond what is necessary for suppuration: but when this practice is carried farther, it rather retards that salutary process. From the foregoing statement of particulars, it must appear, that in many cases it is unnecessary to check inflammation; in others it would be wrong, and in many very necessary; and probably the best guide is its going further than appears from the cause to be salutary; yet in practice we find applications, and other modes of resolution, immediately had recourse to, which must be considered as opprobrious to surgery.

Inflammations, in consequence of accidents, ought in general to be resolved, if possible. It is perhaps impossible to produce a single instance where a contrary practice would be preferable, except as above related, where its consequence would be to answer some great pur-

pose; and it is also conceivable, that this local disease, produced by accident, might relieve the constitution from some prior disorders, similar to what is understood to be the effects of an issue. Mr. Foote was relieved of head-aches of long standing, by the loss of a leg, which may be considered as a proof of this; but he afterwards died of a complaint in his head, very similar to an apoplexy. It might be supposed, on the other hand, that the temporary cure was the cause of the apoplexy.

Inflammation in consequence only of a disease in a part, appears to be under the same circumstances, with respect to resolution; but an inflammation arising from a preceding indisposition in the constitution (commonly called critical) has always been classed among those which should not be cured locally, and this has got the term of repulsion: it has been insisted on, that the inflammation should rather be encouraged, and suppuration produced, if possible. If the inflammation is really a concentration of the constitutional complaint, and that by not allowing it to rest here, the same disposition is really diffused over the whole animal again, and at liberty to fix on some other part, it certainly would be better to encourage its stay; but in such cases it is always understood that the inflammation is in such parts as will readily



admit of a cure when suppuration takes place; for if the disease be otherwise situated, then the cure of the constitution by suppuration will be a mode of cure which will reflect back another disease upon it, under which it will sink: resolution of inflammation, therefore, in the first of these situations should, if possible, be brought about. For instance, many deep-seated inflammations, if allowed to suppurate, would of themselves most certainly kill. This might be illustrated by the gout, when either in the head or stomach, for when in such parts it had better be repelled, and left to find another part less connected with life; which, if in the feet, would be called repelling of it; but still it does not appear to me necessary that it should suppurate, for suppuration is only a consequence of the inflammation, and not an immediate consequence of the original or constitutional disease, but a secondary one:<sup>n</sup> as suppuration, therefore,

<sup>n</sup> This is contrary to the common received opinion, but it is according to my idea of suppuration, for I have all along considered inflammation as the disease, and suppuration only as a consequence of that disease; and have supposed the disease to be gone when suppuration has taken place: but according to the common opinion, suppuration was the thing to be wished for; because all diseases arose from humours; but as we have not once mentioned humours, and therefore made it no part of our system, we must also drop it at present.

is only a thing superadded, and as we shall find that inflammation generally subsides when suppuration comes on, I see no reason why inflammation, in the present case, should not as well subside by resolution as by suppuration: however, it may be supposed, that although suppuration is not the natural, or immediate effect of the disease, yet as it is a continued local action, and the thing sought for by the constitution, and as inflammation must precede it, the parts must submit to those regular processes; for it must be supposed to be capable of diverting the disease to this part.

X. *Of the methods of resolution by constitutional means.*

THE first thing to be considered is the kind of inflammation, when visible, which will in some degree shew the kind of constitution: the next is the nature of the part inflamed, and the stage of inflammation; for upon these depends in some measure the method of relief. In cases of exposed internal surfaces, the inflammation cannot be resolved, because the cause still exists till inflammation has resolved itself; but it may be lessened, and this probably takes place by lessening every thing which has a tendency to

keep it up ; and in all likelihood, little more can be done in spontaneous inflammations ; for as yet we know of no method which will entirely quiet or remove the inflammatory disposition or mode of action, as there is no inflammatory specific with which we are acquainted. When I described inflammation, I observed there was either an increase of life, or an increased disposition to use with more violence the life which the machine, or the part was in possession of ; and also there was an increased size of vessels, and of course an increased circulation in the part inflamed, and in the constitution in general. If this theory of the mode of action of the vessels in inflammation is just, then our practice is reducible to two principles ; one consisting in removing the cause of that action ; the other in counteracting the effect. In the first, as we seldom know the cause, but only see the effect, except in some specific diseases, for which we have a specific remedy, we do not know with any degree of certainty how to act ; but as the second, that is, the effect, is more an object of our senses, we can apply with more certainty our reasoning upon it ; for reasoning from analogy will assist us in our attempts. We find, from common observation, that many circumstances in life, as also many applications to parts, will call forth the contraction of the

vessels: we are, from the above theory, to apply such means; and whatever will do this, without irritation, will so far counteract the effect.<sup>o</sup> I have already observed, that wherever there has been a violence committed, or some violent action is going on, there is a greater influx of blood to that part. Lessening, therefore, that influx becomes one mode of relief; for as the vessels dilate, they should not be encouraged in that action. Although the increased influx is to be considered chiefly as an effect, yet it is to be considered as a secondary cause; and from our ignorance of the immediate cause, it is probably only through such secondary causes that we can produce any effect; and upon these principles, most likely rests, in some measure, the method of resolution; for whatever will lessen the power and disposition, will also lessen the effect; and possibly these will likewise lessen the force of the circulation.

If the inflammation is attended with considerable action and power, as it were, increasing itself, then the modes of resolution are to be

<sup>o</sup> As this is a new theory of the action of the vessels in inflammation, and the only one that can possibly direct to a method of cure, it is to be hoped that attention will be paid to it; and, if just, that more certain methods of resolution will be discovered.



put in practice; the one by producing a contraction of the vessels, the other by soothing or lessening irritability, or the action of dilatation.

The first, or contraction of the vessels, is produced in two ways: one by producing weakness; for weakness excites the action of contraction of the vessels; the other, by such applications as induce the vessels to contract.

The means of producing absolute weakness are bleeding and purging: but the bleeding also produces irritability for a time, and is often attended by a temporary weakness of another kind, viz. sickness.

The inconvenience, however, arising from this practice is, that the sound parts must nearly in the same proportion, suffer with the inflamed; for, by bringing the inflamed part upon a par with health, the sound parts must be brought much lower, so as to be too low. The soothing may be produced by sedatives, relaxants, antistimulants, etc. such as many sudorifics, anodines, etc.

The first method will have the greatest, the most permanent, and the most lasting effect; because if it has any effect at all, the diseased action cannot be soon renewed. The second will act as an auxiliary; for so far as irritation is a cause, this will also lessen it; and the two should go hand in hand; for wherever we les-

sen power, we should, at the same time, lessen the disposition for action, or else we may increase the disposition; but neither bleeding, purging, nor sickness, can possibly lessen the original inflammatory disposition; for none of them will resolve a venereal inflammation, when mercury will: nor will they resolve the erysepelatous inflammation, although that inflammation has the very action for which we should bleed in the common inflammation, viz. dilatation of vessels. However, these means may in some sense, be reckoned direct; for whatever will produce the action of contraction in the vessels is counteracting the action of dilatation. Lessening the power of action belonging to any disposition, can only lessen or protract the effects, which, however, will be of singular service, as less mischief will be done, and it will often give the disposition time to wear itself out. Means employed, on this principle, should be such as give the feel of weakness to the constitution; which will affect the part, and will make the vessels contract; but this practice should not be carried so far as to produce the sense of too much weakness, for then the heart acts with great force, and the arteries dilate.

Bleeding then, as a general principle, is to be put in practice; but this must be done with judgment; for I conceive the effects of bleed-

ing to be very extensive. Besides the loss of any quantity of blood being universally felt, in proportion to the quantity lost, an universal alarm is excited, and a greater contraction of the vessels ensues, than simply in proportion to this quantity, in consequence, as it would appear, of a sympathetic affection with the part bleeding.

Too much blood in an inflammation, is a load upon the actions of the circulation. Too little produces debility and irritability; because there is a loss of powers, with an increased action to keep up, which is now not supported. It would seem that violent actions of a strong arterial system, required less blood than even the natural actions; and even less still than a weak or irritable system: from whence we must see, that bleeding can either relieve inflammatory action, or increase it, and therefore not to be used at random.

As many patients that seem to require bleeding have been already bled, it may not be improper to inquire how they bear, or are affected by bleeding; for certainly, all constitutions (independent of every other circumstance) do not bear this evacuation equally, and it is probable, that its effects on inflammation may be nearly in the same proportion; if so, it becomes a very useful caution; for although the loss of blood may, as a general principle, be set down

as a weakener, and probably the greatest, as we can kill by such means, yet the loss of certain quantities in many constitutions is necessary for health: this is either when there is a disposition to make too much blood, or a constitution that cannot bear the usual quantity; in such, when known, bleeding with freedom is certainly necessary. If the inflammation is known to be attended with real powers, bleeding is absolutely necessary, in such quantity as to take off from the force of the circulation, which arises from too much blood: or if that is not sufficient, then as much as will cause a contraction of the vessels; but in cases of too great an action of weak parts, then the proper quantity to be taken, is no more than may assist the dilatation of the vessels, which will lessen the violence of motion in the blood, or remove the sensation in the part inflamed, of having too much to do; the quantity, therefore, must be regulated according to the symptoms, and other circumstances; for instance, according to the visible indications.

We are to remark here, that every part of the body, under inflammation, will not bear bleeding alike. I believe that the constitution bears bleeding best, when the inflammation is in parts not vital, and those near the source of the circulation: whatever disturbs some of the vital parts, depresses, but not equally in all; and then it becomes more necessary to be par-



ticular, for in accidents of the brain, bleeding freely, even so as to produce sickness and fainting, is necessary. It is probable, that the sickness attending such accidents, is designed to lessen the influx to the head, and occasion the vessels of the brain to contract.

The indications for bleeding are first, according to the violence of the inflammation, joined with the strength of the constitution, which will in general point out the kind of inflammation. Secondly, according to the disposition to form much blood: thirdly, according to the nature of the part, whether vital or not: fourthly, according to its situation in point of distance from the heart: fifthly, according to the effect of the inflammation on the constitution.

With regard to this evacuation, it is worthy of particular consideration, whether or not in all cases, where it can be put in practice, bleeding in or near the part will answer better than taking the blood from the general habit; for certainly less may be removed in this way, so as to have equal effect upon the part inflamed, (and probably upon every other disease that is relieved by bleeding) and yet affect the constitution less; for although, in many cases, the general habit may be relieved by bleeding, yet the part affected, where it can act, will in all

cases require this evacuation most, and local bleeding will keep nearer these proportions, whereas taking blood from the general system is just the reverse. That local bleeding has very considerable effects on the inflamed part, is proved by the gout; for applying leeches to the part inflamed, commonly relieves that part, and often almost immediately.<sup>p</sup> We find that bleeding by leeches alone will remove a tumour in the breast, having all the appearances of a schirrus, which cannot be considered as inflammatory; its powers, therefore, extend beyond inflammation. We find relief by bleeding in the temporal artery, or jugular vein, for complaints in the brain; or cupping and bleeding with leeches, on or near the part; as applying leeches to the temples in inflammations of the eye.

I have observed that there is something similar to sympathetic affection in bleeding. I conceive that all the sympathetic powers, the universal, continued, and contiguous, may be brought into action from the local influence of bleeding. Thus, bleeding in the part inflamed, I can conceive, does more than simply emptying the vessels mechanically, for that would be

<sup>p</sup> It is not meant here to recommend bleeding in this disease.

soon restored from the general circulation; but it acts by continued sympathy, viz. the vessels of the part being opened, they contract for their own defence, and this is carried further among the vessels of the part; so that bleeding from the part acts in two ways, viz. mechanically, by relieving the vessels of some blood, so as to allow them to contract in proportion as the load is taken off; and also to excite them to contraction, in order to prevent the effusion of blood. I suppose, likewise, that contiguous sympathy comes into action; for this would appear from practice and observation to be a principle in bleeding; therefore in inflammation of contiguous parts, it is proper to bleed from the skin opposite to them, as from the skin of the abdomen, in complaints of the liver, stomach, and bowels; and likewise from the loins in inflammatory affections of the kidneys. In affections of the lungs, bleeding opposite to them is of service; but in such cases, it is not clear where the inflammation is; for if in the pleura, then it does not act upon this principle, but by continued sympathy: bleeding on the scalp relieves head-achs; and the relief given to the testicle by bleeding from the scrotum, in inflammation of that body, proves the principle.

Where the first indication for bleeding takes

place, viz. where there is violent inflammation with strength of constitution, bleeding freely will be of singular service. The same mode of practice is also to be followed under the circumstance of strength, with respect to the second, third, fourth, and fifth; but each will not require the same quantity to be taken under equal strength of constitution, as will be taken notice of when treating of them separately. As it seldom happens that bleeding once will be sufficient in a considerable inflammation, the first, or preceding blood taken, becomes a symptom of the disease. If the coagulating lymph is long in coagulating, so that the globules have time to subside, there will be what is called a thick buff; and if its surface is considerably cupped, then future bleedings may be used with less caution; because such appearance indicates strong powers of coagulation, which always shews strength in the solids; but if the blood is weak in its powers of coagulation, and lies flat in the dish, then we must be cautious in our future bleedings; or if it was strong at first in its powers of coagulation, and after repeated bleedings becomes weak, then we must not pursue this further; but in some cases it is proper to pursue it to this point, for we shall sometimes find that the inflammatory symptoms shall not cease after repeated bleedings, if the strength



continues; but the moment a degree of looseness is produced in the blood, that moment will the inflammatory action cease. The following case is a strong instance of this. A lady had a violent cough, tightness in respiration, loss of appetite, strong sizzly blood, and the symptoms continued to the sixth bleeding, when the blood was not quite so sizzly; but the most remarkable change was, its remaining flat on the surface. Upon this bleeding, all the symptoms disappeared; and here, although the blood became weak in its power of coagulation, yet it did not produce irritability in the constitution, the vessels of the inflamed parts having still had power to contract. On the other hand, there may be indications for bleeding sparingly: first, when there is too much action, with weakened powers: secondly, when there is a disposition to form but little blood: thirdly, when the part affected is far from the source of the circulation.

From the above three dispositions that require bleeding sparingly, or with caution, I may observe, that it will most probably be proper in all such cases to bleed from, or as near the part affected as possible, in order to have the greatest effect, with the loss of the least quantity of blood; more so than when the constitution is strong; because the constitution in such cases

should feel the loss of blood as little as possible; if from the part, leeches will answer best, because commonly little irritation follows the wound of a leech:<sup>a</sup> however this can only be put in practice in inflammations not very remote from the surface. But in many cases the blood cannot be taken away from the part itself, but only from some neighbouring part, so as to affect the part inflamed: thus we bleed in the temporal artery for inflammation in the eyes; we bleed in the jugular veins for inflammation of the brain; and also in the temporal artery, to lessen the column of blood going to the brain, by the internal carotids. But in many situations it will, probably, be impossible to do this, with any hopes of success, and therefore we may have recourse to the sympathetic affections before described.

<sup>a</sup> However, this is not always the case; for it sometimes happens that an unkindly inflammation attends the wound, though not extensive. It sometimes also happens that the lymphatic glands swell in consequence of their bite; but these so rarely occur, and are of such little consequence when they do, that they are not to be regarded. From thence it has been conceived, that there was something poisonous in the bite of a leech; but I think there are no proofs of it; however, from another effect, I conceive there is a power or property applied to the wound, which hinders the irritation of contraction that naturally takes place in a wounded vessel, producing, probably, a paralysis for a time.

Too much action, with small powers, may often, if not always, be classed with the irritable constitution, and bleeding should then be performed with very great caution: one case out of many I shall relate as an instance of great action with debility. A gentleman had one of the most violent inflammations I ever saw, in one of his eyes, attended with violent pain in his head, the blood extremely sizzly, all of which denotes great action of parts; yet the buff of the blood was so loose when coagulated, that it could hardly bear its own weight, or make any resistance to the finger when pressed; and although he was bled pretty freely, yet he never found any relief from it. This blood becoming a symptom, both of the constitution and disease, manifestly showed weak powers from its looseness, and too great action from its slowness of coagulation, which was the cause of the buff.

The following case is another strong instance of great action in a weak, irritable habit. A lady had a violent inflammation at the root of the tongue, so as to form a considerable supuration; with a pulse of one hundred and twenty, one hundred and twenty-five, and often one hundred and thirty, in a minute: her blood was extremely sizzly, yet she received but little benefit from the first bleeding, although the blood coagulated pretty firmly, which indicated

strength. She was of an irritable constitution, so as to receive less benefit from bleeding than another; and when bled three times, the blood became extremely loose in its texture, which bark removed, as well as the other symptoms. Upon leaving off the bark, the symptoms all recurred, and when she was bled again for the second attack, which was the fourth time, the blood, although inflammatory, had recovered a good deal of its proper firmness; but in the second bleeding, for this second attack, it was less so; and in the third it was still less. Suspecting that bleeding in the present case would not produce resolution, I paid particular attention to the pulse at the time of bleeding, and found that in this last bleeding the pulse increased in its frequency even in the time of bleeding; and within a few minutes after the bleeding was over, it had increased ten strokes in the minute.<sup>r</sup> These bleedings retarded suppuration, but by producing irritability they could not effect resolution.

Where there is a disposition to form but

<sup>r</sup> This, of the pulse increasing upon bleeding, is not always to be set down as a sure sign of irritation being an effect; for in a sluggish pulse, arising from too much blood, the increase of stroke and freedom given to the circulation is salutary; but when a pulse is already quick, an increase must arise from irritation.



little blood, when known, bleeding should be performed with great caution.

When the inflammation is far from the source of the circulation, the same precautions are necessary. In general it can be taken away from the part in such cases. But these are only so many facts that require peculiar symptoms to ascertain them.

The common indications of bleeding, besides inflammation, are too often very little to be relied upon; and I shall consider them no further than as it concerns inflammation; which will indeed throw light on other cases. The pulse is the great indication in inflammation; but not always to be depended upon:

In inflammations that are visible, a knowledge of the kind of inflammation is in some degree ascertained, as has been observed; we therefore go upon surer ground in our indications for bleeding: but all inflammations are not visible; and it is, therefore, necessary to have some other criterion: however, if we could ascertain the pulse, peculiar to such and such appearances, in visible inflammation, and that was universally the same in all such appearances, we might then suppose that we had got a true indicative criterion for our guide, and therefore apply it to invisible inflammation, so as to judge of the inflammation by the state of the pulse;

but when we consider that the same kind of inflammation in every part of the body will not produce the same kind of pulse, but very different kinds, not according to the inflammation, but according to the nature of the parts inflamed, and those other parts also not visible, we lose at once the criterion of pulse as a guide. When we consider, also, that there shall be every other sign or symptom of inflammation in some viscus, and from the symptoms the viscus shall be well ascertained, yet the pulse shall be soft, and of the common frequency; and upon bleeding, in consequence of these inflammatory symptoms, the blood shall correspond exactly with all of them, except the pulse; it shall be sizy, firm, and cup, as was the case in a lady which has been before described, we shall be still further convinced that the pulse is a very inadequate criterion. If a pulse be hard, pretty full, and quick, bleeding appears to be the immediate remedy, for hardness rather shews strong contractile action of the vessels not in a state of inflammation, which also implies strong action of the blood; and from such a pulse a sizy blood will generally be found; but even a quick, hard pulse, and sizy blood, are not always to be depended upon as sure indications of bleeding being the proper method of the resolu-

tion of inflammations; more must be taken into the account.

The kind of blood is of great consequence to be known; for although it should prove sizzly, yet if it lies squat in the bason, and is not firm in texture, and if the symptoms at the same time are very violent, bleeding must be performed very sparingly, if at all; for I suspect that under such a state of blood, if the symptoms continue, bleeding is not the proper mode of treatment. The cases of this kind, which have been related, are strong proofs of this.

As the pulse, abstracted from all other considerations, is not an absolute criterion to go by, and as sizzly blood, and a strong coagulum are after proofs, let us see if there are any collateral circumstances that can throw some light on the subject, so as to allow us to judge, *à priori*, whether it be right to bleed or not, where the pulse does not of itself indicate it. Let us remember, that in treating of inflammation of different parts, I took notice of the pulse peculiar to each part, which I may now be allowed to repeat. First I observed that an inflammation in parts not vital, or such as the stomach did not sympathize with, if there were great powers, and the constitution not very irritable, the pulse was full, frequent, and hard. Se-

condly, that on the contrary, in inflammations of the same parts, if the constitution was weak, irritable, etc. that then the pulse was small, frequent, and hard, although perhaps not so much so as when in vital parts. Thirdly, that when the inflammation is in a vital part, such as the stomach, intestines, or such as the stomach readily sympathizes with, then the pulse is quick, small, and hard, similar to the above. Now in the first stated positions we have some guide, for in the first of these, viz. where the pulse is strong, etc. there bleeding is most probably absolutely necessary, and the symptoms, with the state of blood joined, will determine better the future conduct; but in the second, where the pulse is small, very frequent, and hard, bleeding should be performed with great caution; yet in inflammations of the second stated parts, the constitution seems to be more irritable, giving more the signs of weakness, as if less in the power of the constitution to manage.

Bleeding, restricted to two or three ounces, can do no harm by way of trial; and, as in the first case, the symptoms and blood are to determine the future repetition; but in the third or vital parts, viz. either the stomach, or such as the stomach sympathizes with, we are yet, I am afraid, left in the dark respecting the pulse.



Perhaps, bleeding at first with caution, and judging from the blood and its effects upon the other symptoms, is the only criterion we can go by.

The kind of constitution will make a material difference, whether robust or delicate.

The mode of life will also make a material difference, whether accustomed to considerable exercise, and can bear it with ease: constitutions so habituated will bear bleeding freely, but those with contrary habits will not. The sex will likewise make a difference, although the mode of life will increase that difference; therefore men will bear bleeding better than women: even age makes a material difference, the young being able to lose more blood than the old; for the vessels of the old are not able to adapt themselves so readily to the decreased quantity; it even should not be taken away so quickly; and probably the constitution may, in some degree, have lost the habit of making blood, since it has lost the necessity.

The urine will throw some light on the disease; if high coloured, and not much in quantity, it may be presumed, with the other symptoms, that bleeding will be of singular service; but if pale, and a good deal of it, although the other indications are in favour of bleeding, yet it may be necessary to do it with caution.

However, bleeding should in all cases be performed with great caution, more particularly at first; and no more taken than appears to be really necessary; it should only be done to ease the constitution, or the part, and rather lower it where the constitution can bear it: but if the constitution is already below, or brought below a certain point, or gives the signs of it from the situation of the disease, then an irritable habit takes place, which is an increased disposition to act without the power to act with. This, of itself, becomes a cause of the continuance of the original disposition, and therefore will admit neither of resolution, nor suppuration, but continue in a state of inflammation; which is a much worse disease than the former.

Upon any other principle than those above-mentioned, I cannot see why bleeding should have such effects in inflammation as it sometimes has. If considered in a mechanical light, as simply lessening the quantity of blood, it cannot account for it; because the removal of any natural mechanical power can never remove a cause which neither took its rise from, nor is supported by it: however, in this light it may be of some service; because all the actions relative to the blood's motion will be performed with more ease to the solids when the quantity is well proportioned.

It is probably from that connexion between the solids and fluids, that the constitution, or a part, is in a state of perfect quietude, or health, in which we find that the fluids are, and ought to be, in a large quantity; but in a state of inflammation, or increased powers and actions, those proportions do not correspond, at least in the parts inflamed; and by producing the equilibrium between the two, suitable to such a state, the body becomes, so far as this one circumstance can affect it, in a state of health; and this in many cases will cast the balance in favour of health: it is not, however, sufficient to produce this effect in all inflammations.

How far taking the blood from parts peculiarly situated with respect to the parts inflamed, is more efficacious, I believe is not yet determined; as bleeding in the left side for an inflammation in the right, upon the supposed principle of derivation, which might be classed with remote sympathy; but so far as the loss of the blood acts mechanically, viz. so far as it simply empties the vessels, it certainly can have no more effect than if taken in any other way; nor can it affect the living principle, either universally, or locally, more in this mode than in any other; but how far it can affect the sympathizing principle, I do not know.

Bleeding is often performed from no con-

stitutional indication, but only as a preventive, arising from experience; such as in consequence of considerable accidents, as blows on the head, fractured bones, etc. but this is not to the present purpose.

XI. *The use of medicines internally, and of local applications in inflammation.*

EVERY thing given to the body, or applied to the part inflamed, that can abate inflammation, or its effects in the constitution, may be called medicine; such, therefore, divide themselves into constitutional, and local: the first will be internal, the second external; but whichever way they are applied, they that tend to lessen inflammation, have their effects local; for mercury, although given internally, for a venereal ulcer in the throat, yet acts locally on the disease; but those that tend to remove constitutional affections, have their effects constitutional.

The internal medicines generally ordered for the resolution of inflammation, are such as tend to have similar effects to that which is produced by bleeding; namely, lowering the constitution, or the action of the parts; and this has usually been performed principally by



purges; and the medicines that were given to remove, or lessen the effects of inflammation on the constitution, have been such as generally tend to lessen fever, or the effects that the inflammation has upon the constitution.

Purges were generally given in cases of inflammation (probably at first from the idea of humours to be discharged), and such practice will answer best where bleeding succeeds; because it will lower the body to a more natural standard, and of course the inflamed part, as a part of that constitution; but here the same cautions are necessary that were given upon bleeding, because nothing debilitates so much as purging, when carried beyond a certain point. One purging stool shall even kill where the constitution is very much reduced, as in many dropsies: therefore, keeping the body simply open, is all that should be done. However, although purging lowers considerably, yet its effect is not so permanent as that of bleeding: it rather lowers action, without diminishing strength; for if a person was to feel the loss of blood equal to a purge, that sensation would be more lasting.

Many constitutions rather acquire strength upon being gently purged; particularly such as have been living above par; but such strength as is acquired by putting the body in good

order, I should suppose is not inimical to inflammation.

In irritable habits, where the inflammation becomes more diffused, greater caution is necessary, with regard to purging, as well as bleeding; for I observed on the subject of bleeding, that in such constitutions no more blood should be taken than would relieve the constitution, as it were, mechanically, but not such a quantity as to have a tendency towards lowering or weakening that constitution; for in such cases the action is greater than the strength; and whenever the disposition between these two is of this kind, we cannot expect any thing salutary from this mode of treatment, and therefore should not increase it. In such cases the very reverse of the former method should often be practised; whatever has a tendency to raise the constitution above irritability, should be given; such as bark, etc. The object of this last practice consists in bringing the strength of the constitution, and part, as near upon a par with the action as possible, by which means a kindly resolution, or suppuration, may take place, according as the parts inflamed are capable of acting.

Medicines, which have the power of producing sickness, lessen the action, and even the general powers of life, for a time, in conse-

quence of every part of the body sympathizing with the stomach, and their effects are pretty quick.

Sickness lowers the pulse, makes the smaller vessels contract, and rather disposes the skin for perspiration, but not of the active or warm kind; but I believe it should proceed no farther than sickness; for the act of vomiting is rather a counteraction to that effect, and produces its effects from another cause, and of course of another kind, which I believe rather rouse: it is probably an action arising from the feel of weakness, and intended to relieve the person from that weakness. It is similar to the hot fit of an ague; a counteraction to the cold one. There are few so weak, but they will bear vomiting, but cannot bear sickness long.

If we had medicines, which when given internally, could be taken into the constitution, and were endowed with a power of making the vessels contract, such, I apprehend, would be proper medicines. Bark has certainly this property, and is of singular service, I believe, in every inflammation attended with weakness, and therefore, I conceive, should be oftener given than is commonly done; but it is supposed to give strength which would not accord with inflammations attended with too much strength and considerable irritation.

Preparations of lead, given in very small doses, might be given with success, in cases attended with great strength.

Applications to the body to cure or resolve inflammations are, with regard to their mode of application, of two kinds; one is applied to the part inflamed, the other to some distant part: the first may be called local or absolute, respecting the part itself; the second, relative; but even the first may be considered as having a relative effect in one of its modes of action, viz. that called repulsion, from which local applications have by some been objected to, and it is principally local applications that can repel, although not literally.

The first, or absolute effects of medicine, may be divided into two kinds, viz. one, the simple cure of the part; the second procuring an irritation of another kind in the part; both, however, act locally, and their ultimate effect is local. Local applications to a part, where that application possesses really the powers of resolution, must be much more efficacious than any of the other modes of resolution; for instance, mercury has much greater powers when applied immediately to the venereal complaint, than when applied to the nearest surface; where, however, we have not medicines that can resolve



inflammation by application, then of course the other method is the most efficacious; but whether we have external or local applications which have really a tendency to lessen the inflammatory disposition, is not well ascertained. I doubt our being in possession of many that can remove the immediate cause. Such would of course remove the action, or if not wholly, would at least lessen it, and allow the inflammation to go off.

But most of our powers in this way appear to be of the soothing kind, which therefore lessen the action, although the cause may still exist, and hence the effects are also lessened. This either produces a termination of the inflammation, or it is protracted, the cause lessens, and the inflammation wears itself out.

As inflammation has too much action, which action gives the idea of strength, such applications as weaken have been recommended, and cold is one of them. Cold, according to its degrees, produces two very different effects; one is the exciting of action without lessening the powers, the other is absolutely debilitating, while at the same time it excites action, if carried too far: in the first it becomes like suitable exercise to the vascular system, as bodily exercise is to the muscles, increasing strength; but when carried or continued beyond this point it lessens

the powers, and becomes a weakener, calling up the action of resistance after the powers are lessened; therefore cold should not be indiscriminately used, and should be well proportioned to the powers.

Cold produces the action of contraction in the vessels, which is an action of weakness. A degree of cold suddenly applied, which hardly produces more than the sense of cold, excites action after the immediate effect is over, which is the action of dilatation, and which is the effect of the cold bath when it agrees; and as cold produces weakness in proportion to its degree, its application should not be carried too far, for then it produces a much worse disease, irritability; or over-action to the strength of the parts, and then indolence too often commences. Cold might be supposed to act on an inflamed part, similar to its action on a frozen part, restraining action, keeping it within the strength of the part in the one case, so as not to allow death to take place from over-action; and in the other to keep it within bounds.\*

\* As cold can be applied upon two very different principles, it is necessary to mention which is here meant. When cold is applied either within the powers of resistance of the part, to excite heat, or only for so short a time as to give the stimulus of cold, then a re-action takes place, and warmth is the consequence; but if cold is applied beyond the powers

Lead is also supposed to have considerable effects in this way, but I believe much more is ascribed to it than it deserves.

The property of lead appears to be that of lessening the powers and not the action, therefore should never be used but when the powers are too strong, and acting with too much violence: however, lead certainly has the power of producing the contraction of the vessels, and therefore where there is great strength, lead is certainly a powerful application.

Applications which can weaken should never be applied to an irritable inflammation, especially if the irritability arises from weakness: I am certain I have seen lead increase such inflammations, particularly in many inflammations of the eyes and eyelids; and I believe it is a bad application in all scrophulous cases: in such cases the parts should be strengthened without producing action.

Warmth, more especially when joined with moisture, called fomentation, is commonly had

of resistance, then a contraction of the vessels takes place, and that contraction is in some degree permanent; but this must be done with caution, for if continued too long, it will produce debility, and action will be excited which will be irritable. In the present, the application of cold should only be sufficient to excite the contraction of the vessels, and that not continued too long, for reasons above signed.

recourse to; but I am certain that warmth, when as much as the sensitive principle can bear, excites action; but whether it is the action of inflammation, or the action of the contraction of the vessels, I cannot determine; we see that in many cases they cannot bear it, and therefore might be supposed to increase the action of dilatation, and do hurt; but if that pain arises from the contraction of the inflamed vessels, then it is doing good, but this I doubt, because I rather conceive the action of contraction would give ease.

Acids have certainly a sedative power, as also alcohol, and I believe many of the neutral salts.

I believe it is not known that we have the power of adding strength to a part by local application; that, in general, I believe, must arise from the constitution; for although we have the power of giving action, yet this does not imply strength.

Many local applications are recommended to us, respecting many of which I have my doubts.

The mode of cure by an irritation different from the disease, appears to increase the disease, but by destroying the first mode of action it produces another disease, viz. one according to the mode of irritation of the application, and



which more easily admits of a cure than the first. I believe, however, that this takes place principally in specific diseases, and not so readily in common inflammation; for a common inflammation most probably would be increased by it. I have known specific inflammations much more easily cured by their specific medicine than the common inflammation of the same constitution, viz. I have seen a gonorrhœa and a chancre cured much more easily in some constitutions, than an inflammation from an accident, and oftener than once or twice in the same person. However, this mode will not do in all specific diseases, for the scrofula will not change its nature by it, nor will the irritable, although specific. The venereal gonorrhœa (if parts are very irritable) is an instance of this, for irritating injections increase it; still we have many cutaneous inflammations cured in this way; for a pretty strong solution of corrosive sublimate will remove an inflammation of the skin. The unguentum citrinum, mixed with any common ointment, cures many inflammations of the eyelids; yet I believe that artificial irritations are similar to one another; and I do not know if there be any difference between them, although I can conceive one may agree better with some constitutions than others. However, these local or immediate applications

can only be such as come in contact with the disease, which always must be some exposed surface, as when the skin of the eyelids, tonsils, etc. are inflamed; but even there, some part must be affected by continued sympathy, if they produce a cure, as the inflammation generally goes beyond the surface of immediate contact.

That inflammation which admits of repulsion, although by local means, might be considered here; but, from its effects and connexion with the constitution, it comes in more properly with the several relations under which I shall consider it.

## XII. *General observations on repulsion, sympathy, derivation, revulsion, and translation.*

THESE terms are meant to be expressive of a change in the situation of diseased actions in the body, and they are so named according to the immediate cause; for any one disease may admit of any of these modes equally; that is, a disease which admits of being repelled, may admit of being cured by sympathy, which probably includes derivation, repulsion, and translation. That such a principle or principles exist, is, I think, evident; but the precise mode

of action is, I believe, not known; that is, it is not known what part of the body more readily accepts of the action of another; if there are such parts, they might be called correspondent parts, whether the action changes its place from repulsion, sympathy, derivation, or translation. In derivation and repulsion, whether one mode of irritation is better than another, to invite or divert the action, and whether parts of a peculiar action do not require a peculiar irritation to divert them; to all this we are likewise totally strangers.

It is not to my present purpose to go into the different effects of this principle; although I must own it might be as useful a part of the healing art as any; and even more, for it is probably the least known, as being the least intelligible, and therefore the more use may be derived from its investigation.

The operations denominated by these terms, so far as they exist, appear all to belong to the same principle in the animal œconomy, for they all consist either in a change of the situation of a disease or its action; a change of the situation, as in the gout, a change of the action, as a swelling of the testicles in the stopping of a gonorrhœa. This last is not properly a change of the situation of the disease, but only of the general inflammatory action without the specific action; these principles can only produce a change in

the seat of action, not in any of the consequences of disease; they have in some instances a connection with the natural operations of the body, as it were interfering with them; and when that is the case, they in general must produce disease of some kind. Thus, the stopping of the menses, a local natural action, arising from the constitution, which may be effected by local applications, called repelling, by a derangement of the constitution, and by many consequences which depend on a deranged constitution simply; or it may be drawn off by a derangement of the constitution, which is a kind of derivation or revulsion. We find that local applications derange also other parts, which have no visible effect upon the part of application as the above, nor any visible connexion with the parts which assume the action. Thus cold, especially if wet be applied to the feet, will bring on complaints in the stomach and bowels, by sympathy; and the same mode of application of cold, if local, will produce a local complaint; as cold air blowing on a part will bring on rheumatism.

These changes were all supposed formerly to be of more consequence than I apprehend they really are; for they are only the change of situation of disease. They were introduced into the œconomy of disease from the idea of



humors. Repellants were such applications as drove the humours out of a part, which would fall on some other; sympathy consisted in another part taking them up; derivation was a drawing off, or inviting the humours; revulsion was the same; and translation was the moving of humours from one part to another. Thus we have those different terms applied to that connexion of parts, by which one part being affected, some other is affected or relieved; or as in translation, some other part takes up the disease as it were voluntarily, as is often the case in the gout. All of these produce one of the symptoms of a disease, viz. sensation and inflammation; but I believe seldom or ever real diseased structures. This agrees with what was formerly observed, that local inflammations depending on the constitution, seldom or ever suppurate.

I believe that these powers have greater effects in diseases, depending on or producing action and sensation, which are called nervous, than on those producing an alteration in the structure of parts.

Thus, we have the cramp in the leg cured by a gentle irritation round the lower part of the thigh, such as a garter, which may be said to arise from derivation, or sympathy.

I have known in a nervous girl, a pain in one arm cured by rubbing the other.

These cures by derivation, repulsion, translation, etc. do not deserve that name, although the patients are cured of the original disease, as in many cases, there is as large a quantity somewhere else in the body uncured; for example, in those cases where the cure is from some local inflammation being produced, and perhaps more violent than the first; but in other cases where the cure arises only from an action in a part without a diseased alteration of structure, then the cure, in such cases, is performed without any other disease having been produced; such as sickness or vomiting curing a disease of the testicles.

I have already observed that local applications were principally supposed to repel by the first or second mode of action; yet internal medicines having a specific, or what might be called a local action, although given internally, may repel by stopping the diseased action in the part which it chiefly affects, such as mercury falling on the mouth, might repel a disease from the mouth. Hemlock might do the same, with regard to the head; or turpentine with regard to the urethra. In the last, we often find by taking balsams, that by stopping the discharge, a swelling of the testicles comes on, or an irritable bladder. As repulsion in this

way is not so evident, it is less noticed. The uncertainty in the power of medicines, respecting repulsion, has led surgeons into more errors than any other principle in the animal œconomy, with regard to diseases. It has prevented their acting in many cases, where they might have done it with safety and effect. A stronger instance cannot be given than in that species of the venereal disease, called a gonorrhœa, which they did not venture to cure by local applications, for fear of driving it into the constitution, and producing a pox; but they did not consider that a gonorrhœa did not arise from the constitution, but may be said to arise from accident, or at least is entirely local, and therefore no repulsion could take place. The idea of repelling was first introduced when local diseases were supposed to arise from a deposit or derivation of humours to a part, and is still retained by those who cannot or will not allow themselves to think better; yet still the term might be applied to diseased action, for the removal of many diseased actions from a part which fall on some other part, is certainly the repelling of that diseased action; but since it is not subdued, but only driven from the part, as is often the case with the gout, no cure is performed by this means.

Both or either of the two local methods of

removing disease, just now mentioned, viz. whether by simply curing the disease, or by destroying the diseased action, in consequence of exciting an action of another kind, may produce the effect called repulsion; but the former, I believe, can only take place in inflammations arising from the constitution, and which being prevented from settling in this part, return upon the constitution again, and often fall upon some other part, viz. one next in order of susceptibility for such inflammation, as is often the case in the gout, and in many other diseases beside inflammation, as in many nervous complaints. St. Vitus' dance is a remarkable instance of it; but in this case it is not to be considered as a cure of the disease, but only as a suspension of its action in this part.

I could conceive it possible that the second mode of local cure, which is by producing an irritation of another kind, might not repel, although it cured the first or local complaint, because there is in such modes of cure still a larger quantity of inflammation in the part than was produced by the disease (although of another kind); but as the idea of repelling is to have a disease somewhere, although not in the same place, keeping it in the present situation may be as proper, if not more so, than in any other it might go to. But if, on the other



hand, the constitution requires to have a local complaint arising from itself, which, as it were, is drawing off, or relieving this constitutional disposition, then curing the one already formed, by producing another in the same part, can be of no service; for if the artificial disease is not of the same nature with the constitutional one, (which it cannot be) if it destroys the other, then it cannot act as a substitute for the other. We may observe, that by producing an irritation of another kind in the gout, we may destroy the gouty inflammation in the part, but cannot always clear the constitution of it; there is, therefore, no benefit arising from such practice in these cases.

The repelling powers which act from applications being made to the parts immediately affected, or by the change of one disease into another, become the most difficult of any to be ascertained; because it must be very difficult to say, what will merely repel, and what will completely cure, or perfectly change the disease. Repulsion is certainly to be considered as a cure of the part, whatever may be the consequence; and a change in the disease is certainly a cure of the first, although a disease may still exist in the part.

That an artificial irritation made on one part

does not (always at least) cure or remove a diseased irritation of a specific nature in another part, is, I think, evident in many cases, even although that specific should be an affection of the constitution. This at least, was evident in a case of the gout, for when the gout was in some of the vital parts, and sinapisms were applied to the feet, they did not relieve those vital parts, although the inflammation in consequence of the sinapisms was considerable: but this inflammation brought on the gout on the feet; and as soon as this happened, the vital parts were relieved; from which it would appear, that a specific irritation required a specific derivator. It may be supposed that the inflammation, in consequence of the sinapisms, brought on, or produced, such a derangement in the feet as made them more susceptible of the gout; or the inflammation became an immediate cause of the action of gout taking place there.

It is plain too, that where there is a gouty disposition, or a gouty action, in the constitution, a derangement in a part may bring it on; for in the above person, who had still those internal spasms recurring upon the least exercise or anxiety of mind, but was in all other respects, and at all other times well, by applying sinapisms

a second time to his feet, till a considerable cutaneous inflammation came on, the gout attacked the ball of the great toe of the right foot, and the last joint of the great toe of the left, which lasted about two days. This attack of gout, however, did not relieve him of the remaining spasms, as the first did; and therefore was to be considered an additional gouty action. This could certainly not have taken place if the constitution had not been gouty.

In diseases where we have no specific application capable of acting immediately, the advantages gained by derivation, revulsion, or sympathy, are much greater in many cases than by the effects of any local application at present known; and the medicines which are capable of producing this effect are often such as would either have an effect if applied to the diseased part, or would increase it. This arises from the dissimilar actions of the two parts; that is, the diseased actions of the one being similar to or producing the actions of recovery in the other; nor is it difficult to conceive why it should be so; for since the medicines are not specifics, but only invite or remove the disease by that connection which the living powers of one part have with those of another, it is reasonable to suppose that this principle of action

between the parts must be much stronger than the effects of many medicines which have only a tendency to cure; or perhaps no tendency that way at all. Thus we find, that vomits will often cure inflammations of the testicles, when all soothing applications prove ineffectual, and when the same emetic could not have the least effect on the part itself, were it applied to it.

Thus, we also find that a caustic behind the ear will relieve inflammations of the eyes or eyelids, when every application to the parts affected has proved ineffectual, and when this caustic, if applied to the parts themselves only as a stimulant, would increase the disease.

Sympathy, perhaps, (except the continued) includes the mode of action in all of those which I have called relatives, viz. repulsion, derivation, revulsion, and translation; at least it is probably the same principle in the whole. What I would call a cure by sympathy, is producing a curative action in a sound part, that the diseased may take on the same mode of action from sympathy, that it would take on, if the curative was applied to; so that sympathy might even be supposed to repel on cases which would admit of repelling, and fall in some other part, although not the part necessarily where the ap-



plication was made. The difference between derivation, or repulsion, and sympathy, consists in derivation producing a disease in a sound part to cure a disease in another part, as was observed; while sympathy is applying the cure to a sound part to cure the diseased; but in many cases it will be very difficult to distinguish the one from the other.

Sympathy is very universal, or more general than any others; for there are few local diseases that do not extend beyond the surface of contact, which produces continued sympathy; and also there are few parts that have not some connection with some other part, which gives us remote sympathy.

It may be recollected, that when sympathy was treated of, it was divided into continued, contiguous, remote, similar, and dissimilar.

The cure by continued sympathy is that application which we have reason to suppose would cure, if applied to the part itself; such as applying mercury to the skin over a venereal node. The node is cured by its sympathizing with the mercurial irritation of the skin; and the action of the sympathizer here is similar to the action of the part of application. Remote sympathy is seldom or ever produced by a similarity of action in similar parts; but most probably cures by dissimilar modes of action in

the two parts, and therefore might be called dissimilar sympathy, viz. by stimulating the part of application in such a way that the sympathizer shall act in the same way as if the real application of cure was made to it, and yet the mode of action of the part of application shall not be at all similar to the sympathizer. I can even suppose a local disease cured by sympathy and by that medicine which would increase it, if applied immediately to it. Let us suppose, for example, any diseased mode of action, and that this mode could be increased by some irritating medicine, if applied to it; but apply this irritator to some other part which this diseased part sympathises with, and that the sympathetic act in the diseased part shall be the same as if its curative medicine was applied to it, similar to what would have taken place if its specific irritator was applied; then, in such a case, the medicine would cure by sympathy, although it would increase the disease if applied locally, or have no effect at all.

The contiguous sympathy is where it would appear to act from the approximation of dissimilar parts, and therefore is not continued sympathy; neither can it be called remote sympathy, as there appears to be no specific connexion, but to arise entirely from contiguity or approximation of parts. Of this kind are blisters

on the head, curing head-ach; on the chest, curing pains in the chest; to the pit of the stomach, to cure irritations there; to the belly, to cure complaints of the bowels.

The applications which act by contiguous sympathy, are only those which can be applied to the nearest surface to that which is inflamed, and the inflamed part beyond this surface becomes affected in some degree, similar to the part of application, such as the applications to the eyelids, when it is in the eye; to the scrotum, when in the testicle; to the abdomen, when some of the bowels are inflamed; to the thorax, in inflammations of the lungs, etc.

These may be either of the specific, stimulating, or soothing kinds, something which affects the parts in such a manner as that a remote diseased action ceases. It may be specific, as opium applied to the pit of the stomach curing an irritation of that viscus; stimulating, as blisters to cure inflammation in the subjacent viscera, as has been mentioned; soothing, as fomentations to the abdomen to relieve complaints in the bowels.

Derivation means a cessation of action in one part, in consequence of an action having taken place in another; and when this is a cessation of a diseased action, then a cure of that action in the original part may be said to

be performed; this cure was brought into use from the idea of humours; that is, the drawing off of the humours from the seat where they had taken possession; but I believe much more has been ascribed to it than it deserves.

How far it really takes place, I have not been able fully to ascertain in all its parts; that is, how far the real disease is invited, and accepts of the invitation; but I have already observed, that there is such a principle of disease in the animal œconomy, although we must see from derivation, that the same quantity, or perhaps more irritation, is retained in the constitution; yet the artificial irritation produced being either such as more readily admits of a cure than the diseased part, or being in parts which are not so essential to life, an advantage by this means is gained; thus, burning the ear is practised as a cure for the tooth-ach, and the part which is burnt more readily admits of a cure, than the tooth. We also find that blisters often cure or remove deep seated pains, such as head-ach, and relieve the bladder when applied to the perineum. Blisters and caustics behind the ear, cure also inflammations of the eye.

Less may be said on revulsion, since we have explained derivation.

To draw off a disease always implies safe



ground, and can be applied with safety in any disease; revulsion can best be applied, when the disease attacks essential parts where the application cannot be so near as to imply derivation.

Thus we find that vomits will cure an inflammation of the testicles, white swellings, and even venereal bubos; and sinapisms applied to the feet relieve the head.

Translation differs from derivation, revulsion, and repulsion, only as it proceeds from a natural or spontaneous cause, whereas these proceed from an artificial, accidental, or external cause, and the common principle of them all seems to be sympathy; for if not an act of its own, then it must be either repelled, derived, or from sympathy.

Very strange instances of translation are given us; it has been supposed, that pus already formed has been translated to another part of the body, deposited there in form of an abscess, and then discharged: this is an operation absolutely impossible; matter absorbed may be carried off by some of the secretions, such as by the kidneys, which have a power of removing more than they secrete; but the deposition of pus is the same with its formation.

Both revulsion and repulsion may be reckoned a species of translation.

The gout moving of its own accord from the stomach to the foot, or from one foot to the other, may be reckoned a translation of the gout.

XIII. *Of the different forms in which medicines are applied, and the subsiding of Inflammation.*

FOMENTATIONS, or steams, washes, and poultices, are the common applications to a part in a state of inflammation. The first, and last, are commonly applied to inflammation arising from external violence, and proceeding to supuration; the second, commonly to internal surfaces, as the mouth, nose, urethra, vagina, rectum, etc. The action of the two first is but of very short duration.

Fomentations and steams, are fluid bodies raised into vapour: they may be either simple, or compound; simple, as steam, or vapour of water; compound, as steam of water impregnated with medicines.

This mode of applying heat, and moisture, appears from experience to be more efficacious than when these are applied in the form of a fluid; it often gives ease at the time of the application, while at other times it gives great pain; but if it does give ease, the symptoms generally

return between the times of applying it, and with nearly the same violence. How far the application of a medicine for fifteen minutes out of twenty-four hours, can do good, I am not certain: we find, however, that the application of a vapor of a specific medicine, though but for a few minutes in the day, will have very considerable effects: fumigations with cinnabar, may serve as an instance. The fomentations are commonly composed of the decoction of herbs; sometimes the marsh-mallows, etc. but oftener of the decoction of herbs possessing essential oil, which I believe are the best, because I suppose that whatever will excite contraction of the vessels, will in some degree counteract the dilating principle: vinegar, as well as spirits, are put into it; how far they stimulate to contraction, I do not know, but rather believe they remove irritation, which must lessen the inflammatory action.

Washes are in general fluid applications, and are more commonly applied to inflammations of internal surfaces, than of the common integuments: there are washes to the eye, called collyria; washes to the mouth and throat, called gargles; washes to the urethra, called injections; and to the rectum, called clysters; but I am fearful that we are not yet acquainted with the true specific virtues of these washes, at least

there is something very vague in their application. There are, for instance, astringent washes for the inflammation of the eye, such as white and blue vitriol, alum, etc.; stimulating warm gargles for inflammations of the throat, such as mustard, red port, claret with vinegar and honey; but to moderate or resolve external inflammations, they do not apply substances with any such properties. How absurd would it appear to surgeons in general, if any one made use of the same application to an inflammation in any other part; yet I do not know if there is any difference between an inflammation of the eye or throat, and one in any other part, if the inflammations are of the same kind: mercury cures a venereal inflammation, either of the eye or throat, as easily as a venereal inflammation anywhere else, because it is an inflammation of the same kind.

These applications, like fomentations, are of short duration, for there is no possibility of applying these powers constantly, except in the form of a poultice, whose operation is somewhat similar; and, indeed, they are only substitutes for a poultice, where that mode of application cannot be made use of, as I observed with respect to internal surfaces.

Poultices are constant applications, and like fomentations may be of two kinds, either simply



warm and wet, or medicated. The greatest effect that a poultice can produce must be immediate, but its power will extend beyond the surface of contact, although only in a secondary degree.

To the common inflammation, the simplest poultice is supposed to be the best, and that effect I believe is only by keeping the parts easier under the complaint; but I am of opinion, that such do not affect the inflammation any other way. A common poultice is, perhaps, one of the best applications when we mean to do nothing but to allow nature to perform the cure with as much ease to herself as possible.

Poultices may be medicated, so as to be adapted to the kind of inflammation; such as the solution of lead, opium, mercury, etc. in short, they may be compounded with any kind of medicine.

Whatever the disposition is, which produces inflammation, and whatever the actions are which produce the effects, that disposition under certain circumstances, viz. when it arises either from the constitution or the parts, can be removed, and of course the actions excited by it. The disposition for inflammation shall have taken place, and the vessels which are the active parts, shall have dilated, and allowed more blood to enter them, so that the part shall look

red, but no hardness or fulness shall be observed, and the whole shall subside before adhesions have been formed; or if inflammation has gone so far as to produce swelling, which is the adhesive stage of the disease, it by certain methods can be frequently so assuaged as to prevent suppuration taking place, and then the parts will fall back into their natural state, which is called resolution; some adhesions being perhaps the only remaining consequences of the inflammation.

The same methods are likewise often used with considerable success in lessening inflammation arising from violence, so as to prevent suppuration entirely; but in many of these cases they are not sufficient, and in those where it cannot be prevented, yet it may be lessened by the same means.

As the first symptom of inflammation is commonly pain, so is the first symptom of resolution a cessation of that pain, as well as one of the symptoms of suppuration, which is a species of resolution. I have known the cessation of pain so quick, as to appear like a charm, although no other visible alteration had taken place, the swelling and colour being the same.

Why inflammation of any kind should cease after it has once begun, is very difficult to ex-

plain, or even to form an idea of, since yet we have no mode of counteracting the first cause or irritation; it may be supposed to arise from the principle of parts adapting themselves in time to their present situation, which I call custom, and that therefore in order to keep up the inflammation, it would be necessary for the cause to increase, in proportion as the parts get reconciled to their present circumstances; but allowing this to be the cause, it will not account for their returning back to their natural or original state, when this increase of irritation ceases, and only the last or original irritation remains; for upon this principle, they only grow more easy under their present state; or perhaps, which is worse, acquire a habit of it, which may be the cause of many indolent specific diseases.

If we suppose the removal of the original cause to be sufficient to stop the progress of inflammation, and when this is stopped, that the parts cannot easily remain in the same inflamed state, but by their own efforts begin to restore themselves to health; which we can easily conceive to be the case in specific diseases, especially those arising from poisons of such kinds as to be capable of a termination, as the small pox; or where a cure can be administered for the effects of the poison, as in the lues venera; then we must conclude that the inflamed state is an

uneasy state, a force upon the organs which suffer it; like the bending of a spring, which is always endeavouring to restore itself, and the moment that the power is removed, returns back to its natural state again; or it may be like the mind, forgetful of injuries.

#### XIV. *Of the use of the Adhesive Inflammation.*

THIS inflammation may be said in all cases to arise from a state of parts in which they cannot remain, and therefore an irritation of imperfection takes place. It may be looked upon as the effect of wise counsels, the constitution being so formed as to take spontaneously all the precautions necessary for its defence; for in most cases we shall evidently see that it answers wise purposes.

Its utility may be said to be both local and constitutional, but certainly most so with regard to the first. Its utility is most evident when it arises from a disease in a part, whether this proceeds from the constitution or otherwise, and when it does, it must be considered as arising from a state in which that part cannot exist, as in exposure, and therefore is the first step towards a cure. It is often of service in those cases which arise from violence, although not so



necessarily so, the injured parts not being always under the necessity of having recourse to it, as was shewn in treating of union by the first intention.

When the adhesive inflammation arises from the constitution, it may depend on some disease of that constitution; and if so, it may be conceived to be of use to it, especially if it should be supposed to be the termination of an universal irritation in a local one, by that means relieving the constitution of the former, as in the gout; but when it is only the simple adhesive inflammation that takes place, I am rather apt to think that it is more a part of the disease, than a termination of it, or an act of the constitution.

The adhesive inflammation serves as a check to the suppurative, by making parts, which otherwise must infallibly fall into that state, previously unite, in order to prevent its access, as was described in the adhesive inflammation being limited; and where it cannot produce this effect, so as altogether to hinder the suppurative inflammation itself from taking place, it becomes in most cases a check upon the extent of it. This we see evidently to be the case in large cavities, as in the tunica vaginalis after the operation of the hydrocele; for after the water has made its escape, parts of the collapsed sack fre-

quently unite to other parts of the same sack by this inflammation, and thereby preclude the suppurative from extending beyond these adhesions, which so far prevents the intention of the surgeon from having its full effect; and often, on the other hand, the adhesive state of the inflammation takes place universally in this bag, in consequence of the palliative cure, which produces the radical, and thereby prevents a relapse. In the hernia it performs a cure by uniting the two sides of the sack together, by means of slight pressure, so that we should understand perfectly its mode of action, where it can prevent a cure, and where it can perform one. In still larger cavities, such as the abdomen, where often only a partial inflammation takes place, as is frequently the case after child-bearing, and in wounds of this cavity, we find this inflammation produced, which either prevents the suppurative altogether, or if it does not, it unites the parts surrounding the suppurative centre, and confines the suppuration to that point; and as the abscess increases in size, the adhesive inflammation spreads, uniting the parts as it spreads, so that the general cavity is excluded. Thus the suppuration is confined to the first point, and forms there a kind of circumscribed abscess, as will be more fully explained hereafter.

In inflammations of the pleura or surface of

the lungs, the same thing happens, for the adhesive inflammation takes place, and the surfaces are united, which union going before the suppurative confines it to certain limits, so that distinct abscesses are formed in this union of the parts; and the whole cavity of the thorax is not involved in a general suppuration; such cases are called the spurious empyema.

The cellular membrane, every where in the body, is united exactly in the same manner, the sides of the cells throw out, or as it were, sweat out the uniting matter, which fills the cavities and unites the whole into one mass.

The adhesive inflammation often disposes the parts to form a cyst, or bag; this is generally to cover some extraneous body that does not irritate so much as to produce suppuration; such as a sack formed to enclose a bullet, pieces of glass, etc.

With the same wise views it unites the parts or cellular membrane which lies between an abscess, and the spot where that abscess has a tendency to open, as will be more fully explained hereafter, when I come to treat of ulceration.

The lungs are so circumstanced as to partake of the effects of two principles, the one as an internal uniting surface, the other as a secreting surface; the last of which constitutes the peculiar structure and use of this viscus; and

the first is no more than the reticular or uniting substance of those cells. The internal or the uniting membrane of the lungs unites readily by the adhesive inflammation, as in the cellular membrane through the body generally; but the air-cells, like the inner surface of the urethra, nose, intestines, etc. pass directly into the suppurative inflammation, and therefore do not admit of the adhesive, by which means the matter formed is obliged to be coughed up, which produces symptoms peculiar to the parts affected; and it is perhaps almost impossible to produce an inflammation on either of those two surfaces without affecting the other; which, probably, is one reason why the treatment of inflammation in those parts is attended with such bad success.

We cannot give a better illustration of the use of the adhesions produced in consequence of this inflammation, than to contrast it with the erysipelatous, of which I have already given an account.

When the erysipelatous inflammation takes place, the matter gets very freely into the surrounding and sound cellular membrane, and then diffuses itself almost over the whole body; while, in another kind of constitution, the adhesive inflammation would have been produced, to have prevented its progress.

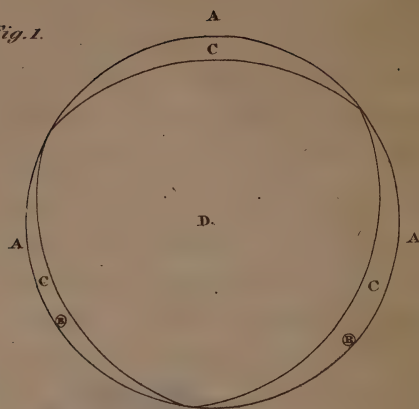


A man was attacked with a violent inflammation on each side of the anus, which I did not see till some days after it began. It had the appearance of the suppurative inflammation joined with the erysipelatous; for it was not so circumscribed as the suppurative, nor did it spread upon the skin like the true erysipelatous, and the skin had a shining œdematous appearance. The inflammation went deeper into the cellular membrane than the true erysipelatous.

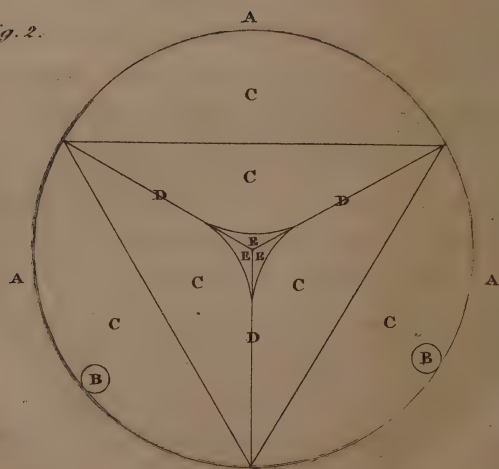
He was bled. The blood was extremely sizzly. He took a purge and was fomented. He had a difficulty in making water, most probably from the pressure of the swelling upon the urethra. The day following I observed that the scrotum of that side was very much swelled, which had extended up the right spermatick chord; on examining this swelling, I plainly felt a fluid in it, with air, which sounded on being shaken. The case now plainly discovered itself. I immediately opened the suppuration on each side of the anus, which discharged a dusky coloured pus, very fœtid, with a good deal of air. Upon squeezing the swelling in the scrotum, etc. I could easily discharge the matter and air by these openings, therefore made him lie principally upon his back, and squeeze these swellings often, with a view to discharge this matter by the openings; the matter at the



*Fig. 1.*



*Fig. 2.*



part where it was formed, was not contained in a bag or abscess, but formed in the cellular membrane, without previous adhesion.

The scrotum now inflamed, and seemed to have a tendency to open; at least it looked livid and spotted. I opened it at this part, and it discharged a good deal of matter and air. A general suppuration came upon the whole cellular membrane of those parts, and the matter passed up through the cellular membrane of the belly; and the cellular membrane of the loins was loaded with matter, from its sinking down from the cells of the abdomen. I made openings there, and could squeeze out a great deal of matter and air. A mortification came on just above the right groin, and when I removed the slough, matter was discharged. I also made openings on the loins, on the side of the abdomen, etc. He lived but a few days in this way, in which time the cellular membrane was hanging out of the wounds like wet dirty tow.

The adhesive inflammation takes place in consequence of accidents, when it is impossible it should ever produce the same good effects, such as in wounds which are not allowed or cannot heal by the first intention; for instance, a stump after amputation, and many other wounds; but it is one of those fixed, and invariable principles



of the animal machine, which upon all such irritations, uniformly produces the uniting process, though, like many other principles in the same machine, these effects are perhaps not so much required, so that although a wound is not allowed to heal, or cannot heal by means of the adhesive inflammation, yet the surrounding parts go through the common consequences of being wounded, and the surrounding cells are united as was described when I treated of union by the first intention. It first throws out the blood, as if the intention was to unite the parts again the newly cut or torn ends of the vessels, however, soon contract and close up, and then the discharge is not blood, but a serum with the coagulating part of the blood, similar to that which is produced by the adhesive state of inflammation, so that they go through the two first processes of union; therefore the use of the adhesive inflammation does not appear so evidently in these cases, as in spontaneous inflammation; however, in case of wounds which are allowed to suppurate, it answers the great purpose of uniting the cells at the cut surface from their being simply in contact with each other, as has been described, which confines the inflammation to that part, without which the irritation arising from this state of imperfection might have been communicated

from cell to cell, and proceed farther than it commonly does. The cut vessels, by this means, are also united, which hinders the progress of inflammation from running along their cavities, as we find sometimes to be the case in the veins of a wounded surface, where this inflammation has not taken place. From every thing which has been said, it must appear, that all surfaces which are suppurating in consequence of this inflammation, have their basis in that state of the adhesive inflammation, which very nearly approaches to suppuration; and this inflammation is less and less, as it recedes further from the supporting centre.

## CHAPTER IV.

*OF THE SUPPURATIVE INFLAMMATION.*

WHEN the adhesive inflammation is not capable of resolution, and has gone as far as possible to prevent the necessity of suppuration, especially in those cases that might have admitted of a resolution, as in spontaneous inflammations in general, where there has neither been an exposed laceration of the solids, nor, as beforementioned, loss of substance, but where the natural functions of the part have only been so deranged that it was unable to fall back into a natural and sound state again; or secondly, where it was a consequence of such accidents as the effects of the adhesive could not in the least prevent, (as in wounds that were prevented from healing by the first or second intention,) then under either of these two circumstances suppuration takes place.

The immediate effect of suppuration, is the produce of the pus, from the inflamed surface,

<sup>a</sup> I have used this word to denote a case where no visible cause of inflammation existed; for strictly there can be no such thing in nature as spontaneous.

which appears in such cases or under such circumstances to be a leading step to the formation of a new substance, called granulations, which granulations are the third method in the first order of parts, of restoring those parts to health; but upon all internal canals, suppuration is certainly not a leading step to granulations, which will be explained hereafter.

The same theory of the adhesive inflammation respecting the vessels is, I believe, applicable to the suppurative; for when suppuration is the first, we have the vessels in the same state as in the adhesive when it happens, but their dispositions and actions must have altered, there being a great difference in their effects.

This is so much the case, that the true inflammatory disposition and action almost immediately ceases upon the commencement of suppuration; and although the vessels may be nearly in the same state, yet they are in a much more quiescent state than before, and have acquired a new mode of action.

I shall endeavour to establish, as an invariable fact, that no suppuration takes place which is not preceded by inflammation; that is, no pus is formed but in consequence of it: that it is an effect of inflammation only, is proved in abscesses, from a breach in the solids attended with exposure, and from extraneous matter of



words, a prevention of union by the first or second intention, or attended with this circumstance of the parts being kept a sufficient time in that state into which they were put by the violence; or, what is something similar to this, violence attended with death in a part, such as in many bruises, mortifications, sloughs in consequence of caustics, etc. which, when separated, have exposed internal surfaces.<sup>b</sup>

Various have been the opinions on this subject; and as every violence committed from without, under the circumstances beforementioned, is exposed more or less to the surrounding air, the applications of this matter to internal surfaces has generally been assigned as a cause of this inflammation; but air certainly has not the least effect upon those parts; for a stimulus would arise from a wound were it even con-

<sup>b</sup> But here we may just remark, that the first processes towards suppuration in cases of mortification, where a separation must take place prior to suppuration, are different from the foregoing; because, the living surface is to separate from it the dead parts, and therefore another action of the living powers is required, which is what I call ulceration; and by the phænomena on this occasion, it would appear that nature can carry on two processes at one and the same time; for while the separation is carried on by the absorbents, the arteries are forming themselves for suppuration; so that at the same time the part is going through these two very different species of inflammation.

tained in a vacuum. Nor does the air get to the parts that form circumscribed abscesses so as to be a cause of their formation, and yet they as readily suppurate in consequence of inflammation as exposed surfaces.

Further, in many cases of the emphysema, where the air is diffused over the whole body, we have no such effect, and this air not the purest, excepting there is produced an exposure or imperfection of some internal surface for this air to make its escape by, and then this part inflames. Nay, as a stronger proof, and of the same kind with the former, that if is not the admission of air which makes parts fall into inflammation, we find that the cells in the soft parts of birds, and many of the cells and canals of the bones of the same tribe of animals, which communicate with the lungs,<sup>c</sup> and at all times have more or less air in them, never inflame; but if these cells are exposed in an unnatural way, by being wounded, etc. then the stimulus of imperfection is given, and the cells inflame, and unite if allowed; but if prevented, they then suppurate, granulate, etc.

The same observation is applicable to a wound made into the cavity of the abdomen of a fowl; for there the wound inflames and unites

<sup>c</sup> Vide Observations on certain Parts of the Animal Economy, page 89.

to the intestines to make it a perfect cavity again; but if this union is not allowed to take place, then more or less of the abdomen will inflame and suppurate.

If it was necessary that air should be admitted in order for suppuration to take place, we should not very readily account for suppuration taking place in the nose from a cold, as this part is not more under the influence of air at one time than at another; nor is the urethra in a gonorrhœa affected by the air more at that time than at any other; these parts being at all times under the same circumstances with respect to air, therefore there must be another cause.

The sympathetic fever has been supposed a cause, which will be considered when I treat of the formation of pus.

In cases of violence I have endeavoured to give a tolerably distinct idea of the steps leading to suppuration; but we are still at a loss with respect to the immediate cause of those suppurations which appear to arise spontaneously; for in these it is almost impossible to determine whether the inflammation itself be a real disease, viz. an original morbid affection, or whether it may not be (as is evidently the case from external violence) a salutary process of nature to restore parts whose functions, and perhaps tex-

ture, has been destroyed by some previous, and almost imperceptible disease or cause. Suppuration being, in cases of violence, a means of restoration, affords a presumption that it is a like instrument of nature in spontaneous cases. If it is the first, viz. a real disease, then two causes that are different in themselves can produce one effect, or one mode of action, for the result of both is the same; but if it is the last, then suppuration must be considered as depending on exactly the same stimulus being given, as in the abovementioned instance of violence.

Suppuration does not arise from the violence of the action of the parts inflamed, for that circumstance simply rather tends to produce mortification; and we see that in the gout, which does not suppurate, there is often more violent inflammation than in many others that do; all internal canals likewise suppurate with very slight inflammation, when not in an irritable habit; but if of a very irritable disposition, the action will almost exceed suppuration, and by its becoming milder, suppuration will come on.

But if we suppose the cause of inflammation to be a disposition in the parts for such actions, without the parts themselves being either diseased, or in such state to be similar to the destruction or alteration of their texture, this inflammation then may arise from a vast variety



of causes, with which we are at present totally unacquainted; nay, which we do not perhaps even suspect; and this last opinion, upon a slight view, would seem to be the most probable, because we can frequently put back these spontaneous inflammations, which would not be the case if they came on from the destruction of a part, or any thing else whose stimulus was similar to it, for no such thing can be done with wounds: if they are not soon united by the first intention, they must suppurate: however, this argument is not conclusive, for we can prevent suppuration in those arising from accident, by uniting them by the second intention, which is preventing suppuration, by acting as a kind of resolution.

Although suppuration is often produced without much visible violence of action in the part, yet when it is a consequence of a healthy inflammation, we find in general that the inflammation has been violent.

It is always more violent than in its preceding inflammation; and in such cases it would appear to be little more than an increased action, out of which is produced an entire new mode of action, and which of course destroys the first.

It is from this violence that it produces its effects so quickly; for the inflammation which is capable of producing quickly so great a change

in the operations of the parts, as suppuration, must be violent; because it is a violence committed upon the natural actions and structure of the parts.

This inflammation will also be more or less, according to the violence of the cause producing it, compared with the state of the constitution and parts affected.

The inflammation which precedes suppuration is much more violent in those cases where it appears to arise spontaneously, than when it arises from any injury done by violence. A suppuration equal in quantity to that from an amputation of the thigh, shall have been preceded by a much greater inflammation than that which is a consequence of the amputation.

This inflammation would seem to vary somewhat in its effects according to the exertion of that power during its progress; for in proportion to its rapidity the cause is certainly more simple, and its termination and effects more speedy and salutary; and this idea agrees perfectly with inflammation in consequence of accidents, for there it runs through its stages more rapidly, and with less inflammation; necessity appears to be the leading cause here.

This seems to be the case even in those parts which have a tendency to slow and specific

diseases; as, for example, in the breasts of women, or the testicles in men. For if these parts inflame quickly, the effects will be more salutary than if they inflamed slowly. In other words, those parts are capable of being affected by the common suppurative inflammation, which in most cases terminates well; perhaps the specific inflammation is slow in its progress and operation, and such slowness marks it to be an inflammation of some specific kind.

In whatever light we view this fact, it at least leads us with more certainty to what the effects of an inflammation will be, and thus often to form a just prognostic.

Suppuration takes place much more readily in internal canals, than internal cavities.

Suppuration takes place more readily upon the surface of canals than in either the cellular or investing membrane. The same cause which would produce a suppuration in the first parts, would only produce the adhesive in the other; for instance, if a bougie is introduced into the urethra for a few hours, it will produce suppuration; while, if a bougie was introduced into either the tunica vaginalis testis, or the abdomen, but for a few hours, it would only give the disposition for adhesions, and even might not go the length of this stage of inflammation in so short a time; but such surfaces often produce a

greater variety of matter than a sore, it is not always pus; and this, probably, arises from the cause not being so easily got rid of. An irritation in the bladder from stone, stricture in the urethra, or disease of the bladder itself, gives us a great variety of matter; pus, mucus, slime, are often all found; sometimes only one or two of them. I have some idea that the mucus is easiest of production; but I am certain, that for the formation of slime, the greatest irritation is required.

### *I. The Symptoms of the Suppurative Inflammation.*

THIS inflammation has symptoms common to inflammation in general; but it has these in a greater degree than the inflammation leading to it, and has also some symptoms peculiar to itself; it therefore becomes necessary to be particular in our description of these peculiarities.

The sensations arising from a disease generally convey some idea of its nature; the suppurative inflammation gives us as much as possible the idea of simple pain, without having a relation to any other mode of sensation: we cannot annex an epithet to it, but it will vary in some degree, according to the nature of the



parts going into suppuration, and what was remarked, when treating of the adhesive state, is in some degree applicable here.

This pain is increased at the time of the dilating of the arteries, which gives the sensation called throbbing, in which every one can count his own pulse from paying attention merely to the inflamed part; and perhaps this last symptom is one of the best characteristics of this species of inflammation. When the inflammation is moving from the adhesive state to the suppurative, the pain is considerably increased, (and which would seem to be the extent of this operation in the part); but when suppuration has taken place, the pain in some degree subsides: however, as ulceration begins, it in some degree keeps up the pain, and this is more or less according to the quickness of ulceration, but the sensation attending ulceration gives more the idea of soreness.

The redness that took place in the adhesive stage is now increased, and is of a pale scarlet. This is the true arterial colour, and is to be accounted a constant symptom, as we find it in all internal inflammations, when at any time exposed, as well as in those that are external.

Besides, I observed in the introduction to inflammation, and when treating of the adhesive state, that the old vessels were dilated, and

new ones were formed; these effects, therefore, are here carried still further in the surrounding parts, which do not suppurate, and constitute two other causes of this redness being increased, by the vessels becoming still more numerous, and the red part of the blood being pushed more forward into many vessels, where only the serum and coagulating lymph went before.

The part which was firm, hard, and swelled, while in the first stages, or the adhesive state, now becomes still more swelled by the greater dilatation of the vessels, and greater quantity of extravasated coagulating lymph thrown out, in order to secure the adhesions.

The œdematous swelling surrounding the adhesive gradually spreads into the neighbouring parts.

In spontaneous suppurations, one, two, three, or more parts of the inflammation lose the power of resolution, and assume exactly the same disposition with those of an exposed surface, or a surface in contact with an extraneous body. If it is in the cellular membrane that this disposition takes place, or in the investing membranes of circumscribed cavities, their vessels now begin to alter their disposition and mode of action, and continue changing till they gradually form themselves to that state which fits them to form pus; so that the effect or

discharge is gradually changing from coagulating lymph to pus; hence we commonly find in abscesses, both coagulating lymph and pus, and the earlier they are opened the greater is the proportion of the former. This gave rise to the common idea and expression, "That the matter is not concocted;" or, "The abscess is not yet ripe." The real meaning of which is, the abscess is not yet arrived at the true suppurative state.

From hence it must appear that suppuration takes place upon those surfaces without a breach of solids or dissolution of parts, a circumstance not commonly allowed;<sup>d</sup> and when got beyond the adhesive state they become similar in their suppuration to the inner surfaces of internal canals.

There is a certain period in the inflammation, when the suppurative disposition takes place,

<sup>d</sup> The knowledge of this fact in some of the larger cavities is not quite new; for I remember, about the year 1749 or 1750, that a young subject came under our inspection, and on opening the thorax it was found on the left side to contain a considerable quantity of pus. Upon examining the pleura and surface of the lungs, they were found to be perfectly entire. This was taken notice of by Dr. Hunter as a new fact, that suppuration could take place without a breach of surface; and he sent to Mr. Samuel Sharp to see it. It was also new to him, and he published it in his *Critical Inquiry*. Since that period it has been often observed in the peritoneal inflammation.

which is discovered by new symptoms taking place in the constitution, viz. the shivering.

Although the sudden effects produced in the constitution would shew that this change of disposition is pretty quick, yet its effects in the parts must be far from immediate, for some time is required for the vessels to be formed by it, so as to produce all the consequences intended by nature; and, indeed, we find it is some time before suppuration completely takes place; and that it is sooner or later according as the inflamed state is backward in going off; for while the inflammation lasts, the part, as it were, hangs between inflammation and suppuration.

The effect of inflammation appears to be the producing of the suppurative disposition, or that state of a part which disposes it to form pus; in doing this the inflammation seems first to be carried to such a height as to destroy that state of the parts on which itself depends, the consequence of which is, that they lose the inflammatory disposition, and come into that which fits them for forming pus.

It seems to be a fixed and most useful law in the animal œconomy, that in spontaneous inflammation, when it has either destroyed the natural functions of parts, so much as to prevent their returning by a retrograde motion, as it were, to the state from whence they set



out, or where the first cause was a destruction of the natural functions, as an exposure of internal surfaces, that they form a disposition to the second method of cure. That the disposition for suppuration is very different from the actual state of inflammation, though produced by it, is proved by a variety of observations; for no perfect suppuration takes place till the inflammation is gone off; and as the inflammation ceases, the disposition to suppuration gradually comes on. If too by any peculiarity in the constitution or inflammation by which it is continued, or if by any accident an inflammation is brought on a healthy sore, the discharge and other appearances become the same as they were when the part from whence they arose was first in an inflamed state, very different from those observed when it was arrived at the state of a kind of suppuration.

## II. *Of the Treatment necessary in Inflammation, when Suppuration must take place.*

IN cases of inflammation arising from accident, but so circumstanced, that we know suppuration cannot be prevented, the practice will be to moderate the inflammation, if necessary, but not with a view to prevent suppuration; for

if the powers are very great, and the violence committed very considerable, the inflammation will probably be very violent; and if it should have equal effects on the constitution, which will be in proportion to the quantity of surface inflamed, then certain constitutional means of relief will be necessary, such as bleeding, purging, regimen, and perhaps producing sickness; because, while that inflammation continues to have effects upon the constitution, the suppuration which takes place will not be so kindly, as it would otherwise be; but if the constitution is of the irritable kind, which will be generally known by the inflammation, the same practice as mentioned above is necessary; in short, whatever is to be the consequence, whether resolution or suppuration, the irritability and the too great action of the vessels, whether arising from too great powers, or too great action with small powers, are to be corrected or removed, as they in all cases counteract salutary operations.

In cases where the constitution has sympathized much with the inflamed part, such medicines as produce a slight perspiration much relieve the patient; such as antimonials, Dover's powders, saline draughts, spirits of mendereries, etc. because they endeavour to keep up an universal harmony, by putting the skin in good

humour, which quiets every sympathizing part, and by counteracting the effects of the irritability. Opium often lessens actions, although it seldom alters them, when only given as an opiate, and may be of a temporary service: however, this is not always a consequence of opium, as there are constitutions where it increases irritation, and of course diseased action.

Fresh wonnds, considered simply as wounds, are all of the same nature, and require one uniform treatment; the intention being to put them into that situation in which they can suppurate with most ease to themselves; and the first dressings commonly remain till suppuration comes on, unless some peculiarity from the situation of parts, or other collateral circumstances, should make it necessary to remove the dressings or vary the treatment.

The difference between one wound and another, with respect to the nature of the part wounded, will vary very much; some will have small vessels wounded that cannot be conveniently got at in order to tie them up, yet should be stopt from bleeding, which can be done by the mode of dressing, and therefore require dressing suitable to this circumstance alone.

Wounds opening into cavities where peculiarities of the contained parts are joined with the injury done to them by the accident will require a suitable mode of dressing; the influence too that a simple wound in the containing parts may have upon those in the cavity, as a wound into the belly, thorax, joints, skull, etc. will oblige the surgeon to vary the mode of dressing from that of a simple wound. While many wounds will require being kept open for fear of uniting again, in order to answer some future purpose, as the wound made into the tunica vaginalis testis, for the radical cure of the hydrocele; others may require attention being paid to them before suppuration comes on, and therefore should be so dressed as to admit of being soon and easily removed, to examine the parts occasionally as the symptoms arise. This ought to be the case in wounds of the head, attended or not attended with fracture of the skull. But whatever mode of application may be thought necessary to answer the various attending circumstances, yet as they are all wounds which are to come to suppuration, one general method is to be followed respecting them all, as far as those peculiarities will allow.

The application which has been made to wounds for some years past in this country, has been in general dry lint. What brought this



application into common practice, most probably was, its assisting in stopping the hemorrhage; and as most wounds are attended with bleeding, it became universal; but as it became universal, it lost the first intention, and became simply a first dressing.

I need hardly remark here, that all wounds that are to suppurate, are first attended with inflammation, and therefore are so far similar to spontaneous inflammations which are to suppurate. If this observation is just, how contradictory must this mode of treatment be to common practice, when spontaneous inflammation has already taken place; for let me ask, where is the difference between an inflammation with a wound, and one without? And also, what should be the difference in the application to a part that is to inflame, (while that application is made to the part) and one applied to an inflammation which has already taken place? The answer I should make to such a question is; there is no difference.

Wounds that are to suppurate, I have already observed, are first to go through the adhesive and suppurative inflammation. These inflammations in a wound, are exactly similar to those spontaneous inflammations which suppurate and form an abscess, or those inflammations which ulcerate on the surface, and form a sore.

The applications to these which are now in practice, I have formerly observed, are poultices and fomentations; these, however, appear to be applied without much critical exactness or discrimination, for they are applied before suppuration has taken place, and where it is not intended it should take place; they are applied to inflammations where it is wished they should suppurate; and applied after suppuration has taken place. Now, with respect to suppuration itself, abstracted from all other considerations, the indication cannot be the same in all of those states; but if poultices and fomentations are found to be of real service in those two stages of the disease, then there must be something common to both, for which they are of service, abstracted from simple suppuration. I also formerly observed, that poultices were of service when the inflammation had attacked the skin, either of itself, or when an abscess had approached so near that the skin had become inflamed, and that this service consisted in keeping the skin soft and moist. This appears to me to be the use of a poultice in an inflammation, either before suppuration or after, as inflammation still exists, till it is opened; for inflammation is necessary in an abscess, while it is making its approaches to the skin, which I have called the ulcerative, and then, and only then, it

begins to subside; it is therefore still proper, in as much as it is of service to inflammation; so far, therefore, their practice is right and consistent, as the first reason exists through the whole; but when applied to inflamed parts, which are meant not to suppurate, their reasoning or principles upon which they applied it must fail them, although the application is still very proper.

If my first proposition is just, viz. that wounds which are allowed to suppurate, are similar to inflammations that are also to suppurate, then let us see how far the two practices agree with this proposition. Lint, I have observed, is applied to a fresh wound, which is to inflame; and the same lint is continued through the whole of the inflammation till suppuration comes on, because it cannot be removed. Lint, considered simply as an application to fresh wounds which are to inflame, is a very bad one, for it more or less adheres to the surface of the wound, by means of the extravasated blood; hence it becomes difficult of removal, and often shall remain in sores for months, being interwoven with the granulations, especially when applied to the surface of circumscribed cavities, such as the tunica vaginalis testis, after the operation for the hydrocele; however, this is not always the greatest inconvenience, the circum-

stance of its being loaded or soaked with blood, subjects it to become extremely hard when it dries, which it always does before the separation takes place, which separation is only effected by the suppuration. In this way it becomes the worst dressing possible for wounds.

As poultices are allowed by most to be the best application to an inflamed part, not attended by, or a consequence of a wound, but considering it simply as an inflammation, I do conceive that the same application is the best for every inflammation, let it be from whatever cause; for the idea I have of the best dressing to a wound, simply as a wound which is to inflame, is something that keeps soft and moist, and has no continuity of parts, so that it is easily separated. The only application of this kind is a poultice, which, from these qualities, is the very best application to a fresh wound. It keeps it soft and moist, and is at all times easily removed, either in part or the whole.

The same medical advantage is gained here, as when it is applied to an inflamed part; but although it had not these advantages, yet the circumstance of being easily removed is much in its favour, especially when compared to dry lint.

But a poultice, from other circumstances, cannot at all times and in all places be conveniently applied.



To preserve the above properties, it is necessary there should be a mass, much too large for many purposes; but when they can be used with tolerable convenience, they are the best applications. When they cannot be applied with ease, I should still object to dry lint, and would therefore recommend the lint to be covered with some oily substance, so that the blood shall not entangle itself with the lint, but may lie soft, and come easily off.

This mode of dressing should be continued for several days, or at least till fair suppuration comes on, and when that has taken place, then dry lint may be with great propriety used, except the sore is of some specific kind, which is seldom the case in fresh wounds; for accidental wounds seldom happen to specific diseases; and a wound in consequence of an operation should not be specific, because the specific affection (if there is any) should have been removed by the operation; and should therefore be a wound in the sound part; as after an amputation of a scrofulous joint, or the extirpation of a cancerous breast. Or if they take on some specific disposition afterwards, then they must be dressed accordingly, as will be explained hereafter.

Poultices are commonly made too thin, by

which means the least pressure, or their own gravity, removes them from the wound; they should be thick enough to support a certain form when applied.

They are generally made of stale bread and milk; this composition, in general, makes a too brittle application; it breaks easily into different portions, from the least motion, and often leaves some part of the wound uncovered, which is frustrating the first intention.

The poultice which makes the best application, and continues most nearly the same between each dressing, is that formed of the meal of linseed; it is made at once<sup>e</sup> and when applied it keeps always in one mass.

Fomentations are generally applied at this stage of the wound, and they generally give ease at the time of application, which has (joined with custom) been always a sufficient inducement to continue them. As soon as supuration is well established, the part may then be dressed according to the appearances of the sore itself.

The kind of wound to which the above application is best adapted, is a wound made in a sound part, which we intend shall heal by gra-

<sup>e</sup> Take boiling water, q. s. and stir in the linseed till it becomes of a sufficient thickness, and then add a small quantity of some sweet oil.

nulation. The same application is equally proper, where parts are deprived of life, and consequently will slough. It is therefore the very best dressing for a gun-shot wound, and probably for most lacerated wounds. For lint applied to a part that is to throw off a slough, will often be retained till that slough is separated, which will be for eight, ten, or more days.

In the treatment of wounds that are to suppurate, it is in one view of the subject right to allow the parts to take their natural and spontaneous bent. From the natural elasticity of the skin, and the contraction of muscles, the parts wounded are generally exposed, and from the consequent inflammation, they generally become more so. This is commonly more the case in wounds produced by accident; for as a small wound and much old skin are always desirable, surgeons very wisely are anxious to wish for both. In many operations, they are desirous of preserving the skin, viz. where they are removing parts, as a limb; dissecting out tumors, or opening an abscess; all of which is extremely proper, and they continue to practice upon this principle, immediately upon the receiving the wound, and in performing any of the above-mentioned operations; for the skin, after ampu-

tation, is drawn down, and bound down, and the wounds are pressed together by bandages. In one point of view, this is beginning too early; it is beginning it when nature has the very opposite principle in view. Inflammation, the parts must submit to; and as inflammation by its effects will generally have a tendency to make them recede more, in this light it is proper not to check the effects of inflammation, therefore let them take their own way till inflammation subsides, and granulations are formed, which granulations, I have already observed, by their power of contraction, will do what we wanted to have done; and if, from some of the first circumstances not being properly attended to, the contraction of the granulations is not sufficient, then is the time to assist, and not before. However, if we take up this in another point of view, we shall see a considerable utility arising from bringing the skin as much as possible over the wound, and keeping it there; for in the time of inflammation the parts will adhere or unite in this situation, by which means the sore will be less than it otherwise would; and I conceive that this practice, when begun, should be for some time continued, for fear the adhesions may not be sufficient to stand their ground till the granulations can assist.

It often happens in many wounds, both



from accident and operations, that part of the wound may with great propriety be healed by the first intention; such as in many accidents on the head, when a part of the scalp has been torn off, on the face, etc. as also after many operations, especially where the skin is loose, as in the scrotum; or where the skin has been attended to in the time of the operation, as in some methods of amputation, extirpation of breasts, etc. a part of the saved skin, etc. may be made to unite to the parts underneath by the first intention, and therefore only part of the wound allowed to suppurate; in all such cases, a proper contracting or sustaining bandage may be applied with great advantage; even stitches may be used with great propriety, as was recommended in the healing of wounds by the first intention.

### III. *The Treatment of the Inflammation when Suppuration has taken place.*

IN spontaneous inflammations, whether from a constitutional or local affection, when suppuration has taken place, it is most probable that another mode of practice must be followed than that which was pursued to prevent it; but even now, if a stop could be put to the further

formation of matter, after it has begun, it would in many cases be very proper, and still prevent a great deal of mischief. Suppuration does certainly sometimes stop, after having begun, which shows that there is a principle in the animal œconomy of diseases from which the machine is capable of producing this effect.<sup>f</sup>

<sup>f</sup> I have formerly observed, that the inflammation goes off often without producing suppuration; and I have also mentioned instances of suppuration going off without the parts having produced granulations, and then the parts fall back into the adhesive state, and the matter being absorbed, they are left in nearly the same state as before the inflammation came on; as a presumptive proof of this, in many of the large cavities, which have been allowed to inflame and suppurate, (by having been opened) we find them often doing well, without ever forming granulations; and that suppuration generally goes off; and I do not believe ever fall back into the adhesive state, so as to unite the parts, but the parts resume their original and natural state or disposition, and no adhesions are formed; this appears sometimes to happen in cases of the empyema after the operation has been performed; I have seen cases where wounds had been made into the cavity of the thorax, where there was every reason to suppose the whole cavity was in a state of suppuration, and yet those patients got well; I can hardly suppose that in these cases the parts had granulated and united in the cure, as the cellular membrane does; because I have seen many similar cases, where the patients have died, and no granulations have been found; and I have seen cases of the hydrocele attempted to be cured radically by the caustic; when the slough came out, suppuration came on; but the orifice healing too soon, suppuration has ceased, and the cure was thought to be

I have seen buboes cured by vomits, after suppuration has been considerably advanced; and it is a very common termination of scrofulous abscesses; but in scrofulous abscesses we very seldom find inflammation; this process appears to be a leading circumstance in ulceration, which is the very reverse of union; even in superficial sores, which are the most likely to continue suppuration, if excited, we find by allowing them to scab, when they will admit of it, that the act which admits of scabbing is the reverse of suppuration, and it ceases; however, it is a process which the animal œconomy does not readily accept of, and our powers in producing this effect are but very small: if these powers could be increased by any means, it would be a salutary discovery; because suppuration itself, in many cases, proves fatal; for instance, suppuration of the brain and its mem-

completed; but a return of the disease has led to another attempt, and by laying open the whole sack, it has been found that the tunica vaginalis was perfectly entire. In such the fluids were a motherly serum. I have seen abscesses go back in the same manner: but I believe that this process is more common to scrofulous suppurations than any other; and I believe to the erysipelatous. I have seen joints heal after having suppurated and been opened, without having produced granulations, leaving a kind of joint, even when the cartilages have exfoliated from the ends of the bones, which was known by the grating of the two ends of the bones on one another.

branes; of the thorax and its contents; as well as of the abdomen and its contents; in short, suppuration of any of the vital parts often kills of itself, simply from the matter being produced; but this practice will by most be forbid in many cases of suppuration; for it is supposed this very suppuration is a deposit of matter or humours already formed in the constitution; but it is to be hoped that time and experience will get rid of such prejudices.

When suppuration cannot be stopped or resolved, then in most cases it is to be hurried on, which generally is the first step taken by surgeons.

How far suppuration can be increased by medicine or application, I do not know; but attempts are generally made; and thence we have suppurating cataplasms, plasters, etc. recommended to us, which are composed of the warmer gums, seeds, etc. but I doubt very much if they have considerable effect in this way; for if the same applications were made to a sore, they would hardly increase the discharge of that sore, probably rather decrease it; however, in many cases, where the parts are indolent, and hardly admit of true inflammation, in consequence of which a perfect suppuration cannot take place; by stimulating the skin, a more



salutary inflammation may be produced, and of course a quicker suppuration: but in the true suppuration, where inflammation preceded it, I believe it is hardly necessary to do any thing with respect to suppuration itself; however, from experience, I believe these applications have been found to bring the matter faster to the skin, even in the most rapid suppurations, which was supposed to be an increased formation of matter; but it can only be in those cases where the inner surface of the abscess is within the influence of the skin. This effect arises from another cause or mode of action being produced, than that of quickening suppuration, which is the hastening on of ulceration. I have mentioned that ulceration was an effect of, or at least attended by inflammation; and, therefore, whatever increases that inflammation, will also increase the ulceration, which will bring the matter sooner to the skin, without an increased formation of matter.

Poultices of bread and milk are commonly used to inflamed parts when suppuration is known to have taken place; this application can have no effect upon suppuration, excepting by lessening inflammation, or rather making the skin easy under it; for we observed, that true suppuration did not begin till inflammation was

abated; but the inflammation must have reached the skin before poultices can have much effect, for it can only affect that part.

It may be thought necessary that the ease of the patient should be considered, and we find that fomentations and poultices often produce that effect; we find too, that by keeping the cuticle moist and warm, the sensitive operations of the nerves of the parts are soothed, or lulled to rest; while, on the contrary, if the inflamed skin is allowed to dry, the inflammation is increased, and as probably suppuration is not checked by such treatment, it ought to be put into practice; as warmth excites action, it is probable, the warmer the fomentation, so much the better; and in many cases the action is increased so that they can hardly bear it.

#### IV. *Collections of Matter without Inflammation.*

I HAVE hitherto been describing true suppuration, which I have said, "I believe is a consequence only of inflammation," a process generally allowed. Also in treating on the cause of suppuration, viz. inflammation, I hinted, that there were often swellings, or thickening of parts without the visible or common symptoms of inflammation, viz. without pain, change of

colour, etc. and I also hinted, in treating of suppuration, that there were collections of matter somewhat similar to suppuration, which did not arise in consequence of the common inflammation; these I shall now consider: I conceive all such collections of matter to be of a scrofulous nature; they are most common in the young subject, and seldom found in the full-grown, or old. It is commonly called matter, or pus, and therefore I choose to contrast true suppuration with it. Although I have termed this suppuration, yet it has none of its true characters, any more than the swellings, which are the forerunners of it, have the true characters of inflammation; and as I did not call them inflammatory, strictly speaking, I should not call this suppuration; but I have no other term expressive of it.

Many indolent tumors, slow swellings in joints, swellings of the lymphatic glands, tubercles in the lungs, and swelling in many parts of the body, are diseased thickenings, without visible inflammation; and the contents of some kinds of incysted tumor; the matter of many scrofulous suppurations, as in the lymphatic glands; the suppuration of many joints, viz. those scrofulous suppurations in the joints of the foot and hand; in the knee called white swellings; the joint of the thigh, commonly

called hip-cases; the loins, called lumbar abscesses: the discharge of the abovementioned tubercles in the lungs, as well as in many other parts of the body, are all matter formed without any previous visible inflammation, and are therefore, in this one respect, all very similar to one another. They come on insensibly; the first symptom being commonly the swellings, in consequence of the thickening, which is not the case with inflammation, for there the sensation is the first symptom.

These formations of matter, although they do approach the skin, yet do not do it in the same manner as collections of pus. They do not produce readily either the elongating or the ulcerative process, and as the matter was not preceded by the adhesive inflammation, these collections are more easily moved from their original seat into some other part, by any slight pressure, such as the weight of their own matter, which I have called abscesses in a part, in opposition to abscesses of a part: when the matter does approach the skin, it is commonly by merely a distention of the part, coming by a broad surface, not intended with any marks of pointing.

Their surrounding parts or boundaries are soft, not being attended with thickening; more especially those in a part.



Such collections of matter are always larger than they would have been if they had been either a consequence of inflammation, or attended by it; this is owing to their indolence, allowing of great distention beyond the extent of the first disease, even moving into other parts; whereas, an abscess, in consequence of inflammation, is confined to the extent of inflammation that takes on suppuration, and its rapid progress towards the skin prevents distention, and of course extension of the disease.

All those formations of matter, not preceded by inflammation, nor a consequence of it, are, I believe, similar to each other, having in this respect one common principle, very different from inflammation. The cancer, although it produces a secretion, yet does not produce pus till exposed; it is, therefore, one of those diseases, like the scrofula, which does not suppurate till inflammation comes on, and even seldom then; for true suppuration arises from inflammation, terminating in a disposition to heal, which is not the case with cancer. In the scrofulous suppuration there is often a like reluctance to heal.

The kind of matter is another distinguishing mark, between that produced in consequence of inflammation, and what is formed without it; the last being generally composed of a curdly

substance, mixed with a flaky matter: The curdly substance is, we may suppose, the coagulating lymph deprived of its serum,<sup>s</sup> and the other, or flaky, is probably the same, only in smaller parts; it looks like the precipitate of animal matter from an acid or alkali.

So far these productions of matter in their remote and immediate cause, are not in the least similar to that arising from common inflammation, nor is the effect, viz. the matter, similar; and to show still further, that suppuration is always preceded by inflammation, the very surfaces which formed the above matter, immediately produced true matter when the inflammation comes on, which it always does whenever opened; which I shall now consider.

Since they are not similar in their causes or modes of production, let us next examine how far they are similar in their first step towards a cure.

All parts which form matter of any kind, viz. whether in consequence of inflammation or otherwise, must go through similar processes to produce the ultimate effect or cure: the first

<sup>s</sup> I may observe here, that the coagulating lymph of long standing, is not similar to the recent. This is similar to blood in general, for we find that the blood in aneurisms, which was first coagulated, is very different from that which has only coagulated lately.

step in either, is the evacuation of this matter, for till this is effected, nature cannot pursue the proper means towards a cure; and if opened, the second step is granulation, and the third cicatrization. To accomplish the evacuation of the matter, there are two modes, one is the absorption of the matter, which is very common in the scrofula, or those productions of matter not preceded by inflammation. This produces no alteration in the part, except that it gradually creeps into a sound state, the parts uniting again that had been separated by the accumulation of the matter; it produces, also, no alteration in the constitution. Absorption, however, seldom takes place in suppuration, which is the consequence of inflammation. The other mode of discharging this matter is either by opening the abscess, in order to allow it to pass out, or by allowing ulceration to take place from the inside to produce its escape; and this process, in the present case, having peculiarities different from those arising from inflammation, it is necessary they should be understood. Ulceration, in consequence of suppuration arising from inflammation, is very rapid, especially if the suppuration is so likewise; but ulceration, in consequence of matter being formed, which is not the effect of inflammation, is extremely slow; it will remain months, even years, before

the parts have completely given way; they commonly come to the skin by a broad surface, and not pointing like a circumscribed abscess in consequence of inflammation; so far are these two different.

V. *Of the Effects such Formations of Matter have on the Constitution.*

WHATEVER may be the extent of such collections of matter, they seldom or ever affect the constitution, unless they are seated in a vital part, or so connected with it as to disturb its functions.

This is an effect of indolence in any disease. A young person shall have a lumbar abscess, for instance, for years, without a single constitutional symptom. It shall appear to be making its way through a number of parts, such as the loins behind, the buttocks, the lower part of the abdomen before, and through the upper part of the thigh; and in each part shall shew large collections of matter. All these shall even attend the same person, yet not any bad symptoms, no shiverings shall accompany this suppuration.<sup>b</sup> In some there is not even the

<sup>b</sup> I have heard surgeons ask such patients, if they had rigors, even alluding to the time of increase; this was applying



least degree of lameness, but this is often the first stage of the disease in the lumbar abscess.

Let us next consider and compare the consequences attending these two collections of matter when opened. When an abscess, in consequence of inflammation, is opened, it immediately proceeds towards a cure, and perhaps it may have gone some steps towards a cure before opening, the inflammation still lessens, the suppuration becomes more perfect, granulations begin to form, and all of these steps naturally take place, because inflammation had been the cause; but when a collection of matter, not preceded by inflammation, is opened, a very different process is first to take place, viz. inflammation is now excited over the whole cavity of the abscess, which afterwards produces a perfect matter, similar to that produced in consequence of inflammation, when it is the original disease; and which now produces its constitutional affection, if it is such as to have connexion with the constitution; but this will depend on the size of the abscess, the situation, and the nature of the parts, etc.: however, it sometimes happens that they inflame before they are opened; but this is in consequence of the matter distending the cavity, and thereby acting the idea of the symptom of one disease to another, and also the first stage of a disease to the second.

as an extraneous body. I have seen white swellings in the knee inflame before they were opened, then ulceration take place, and the pus brought soon to the skin, even after it had been confined for months, without producing the least tendency to ulceration, because there had been none to inflammation; but the confinement of the matter becomes a cause of the inflammation, and then ulceration takes place.

The inflammation and new suppuration taking place in consequence of opening into these abscesses, is exactly similar to those arising in consequence of wounds or openings made into natural cavities; it was still, therefore, necessary that they should go through all the common steps towards restoration; but, unfortunately, such inflammations have begun at the wrong end; they have also set down upon a specific disease, which they can seldom alter to their own nature. The inflammation is in such cases extended over a much larger surface than the original; which is not the case in abscess, in consequence of inflammation, for there the inflammation was the cause and confined to the point.

In some cases, as in lumbar abscess, the extent of surface to inflame is immense, in comparison to the extent of the original disease, and of course, when such abscesses inflame, the

symptoms in the constitution are in the same proportion.

How different is this from the opening of the abscess in consequence of inflammation! There we have no inflammation following, except what arises in consequence of the wound made in the solids in the operation of opening; but when it is allowed to open of itself, there is no consequent inflammation, but suppuration goes on. But it would appear that when those collections of matter are allowed to open of themselves, that the succeeding inflammation does not so readily take place as when opened by art. I have seen large lumbar abscesses open of themselves on the lower part of the loins, which have discharged a large quantity of matter; then closed up, then broke out anew, and so on for months, without giving any other disturbance; but when opened, so as to give a free discharge to the matter, inflammation has immediately succeeded, fever has come on, and from the situation of the parts inflamed, as well as their extent, death in a very few days after has been the consequence; it, therefore, often becomes a question whether we should enlarge the first opening or not. We may observe in general, that in cases of this kind, where they are to terminate ill, that is, where they cannot be cured, and are such as to affect the consti-

tution, the consequent inflammation upon opening them, which produces the sympathetic fever, has that fever commonly terminating in the hectic, or continued in the hectic before any recess takes place, so that the one is continued into the other, without any intermission; however, this is not always the case, and those variations will depend on the state of the sore, the state of the constitution, etc.

#### VI. *The Effects of the Suppurative Inflammation on the Constitution.*

It is to be observed, that every local complaint of any consequence, or which has considerable and quick action within itself, although not of considerable magnitude, affects more or less the constitution, and gives rise to what has been commonly called the symptomatic fever. These symptoms are the sympathies of the constitution with a local disease or injury, and will vary according to a vast variety of circumstances. They will vary according to the nature of the constitution, which admits of great differences, and which will include different ages; they will vary according to the nature of the part in a state of disease, which also admits of great differences; they will vary according to the



quantity of mischief done, as well as the manner of its being done; that is, whether so as to call forth immediate inflammation as a wound; or not so immediate, as from having only killed a part; they will vary according to the situation of similar parts in the body; and they will vary according to the stage of the disease. This last variation may be divided into two kinds: the one which begins slowly and increases progressively, as in the venereal disease, and the sympathetic affections of course come on gradually; the other, where it begins at once with violence and diminishes. The first of this last division we have nothing to do with at present; it is, therefore, the kind of constitution, the kind of parts, the diseases which commence with so much violence as to affect the constitution at once, with the constitutional effects arising from the local disease being incurable, that form our present subject. I shall observe here, that every disease, whether local or constitutional, that has the power of termination in itself, commonly has its regular progress and stated times of action; in some, however, there are no changes in the modes of action, the disease coming on and dying away; but in others there are; and in those where changes take place, there are stated periods for those changes, so as to render them regular. As regularity in the

modes of action in disease is conducive to the termination of that disease, it is a thing very much desired; for these changes are a cessation of the action, either temporary or permanent. As the constitution sympathises with a local irritation, and as that sympathy is according to the constitution, to the violence of the irritation, and to the nature of the parts irritated; and the symptoms of that sympathy must be similar to constitutional complaints that are commonly taking place; and if the local complaint should not be known, then they will be taken for constitutional complaints wholly, and treated as such; but often from their continuance, some local affection is suspected. Local complaints, however, are commonly preceded or attended with some local symptom either directly or indirectly, or with some collateral symptom or symptoms; so as to direct us to the cause. Local complaints attended with inflammation, the objects of surgery, are often attended with, or rather consequent upon violence of some kind; such as the loss of a part, either fluid or solid, which the constitution feels, and which loss, or violence, adds to the constitutional affection. This will be according to the quantity of injury or loss of living matter, whether blood, or some solid, the time in the operation, the

state of the parts operated upon, and the nature of the part removed. I have seen a man die almost immediately upon the loss of a testicle. I have seen convulsions immediately attend the operation for the hydrocele, so that I have almost despaired of recovery. I have seen a most violent sympathetic fever, delirium, and death, follow in consequence of dividing parts in the leg, and searching after a bleeding artery. The loss of a limb above the knee, is more than many can bear; the cutting for the stone, where it breaks, and may be an hour in extracting, is also more than many can bear; the parts being in such a diseased state, as not to be relieved, have continued the symptoms of the disease; and the loss of a testicle, although of so small a size when compared with many other parts which we can lose with impunity, from its vital connexion, is more serious. We cannot bear to lose much brain.

The loss of too much blood is often an attendant on, or a consequence of operations; but sometimes takes place without much violence. This produces very considerable constitutional effects; bringing on weakness, and many complaints, depending, as it were, upon debility, which are what are commonly called nervous. I have seen a locked jaw come on in conse-

quence of the loss of a considerable quantity of blood, the cause of the loss being but trifling, and giving no symptoms whatever.

The nature of the cause of inflammation, produces, I believe, but little variation in the constitution; for of whatever kind it is, the symptoms in the constitution will be in all cases nearly the same, proportioned only to the violence and rapidity of its progress; and as this inflammation is pretty violent, more especially if it produces healthy suppuration, it generally produces more violent effects upon the constitution than any other: this, however, will be in some degree according to the susceptibility of the constitution for inflammation; and if any difference takes place in the inflammation in one constitution from that of another, it will arise from the nature of the constitution, the nature of parts, and their situation, and not from the nature of the cause.

The sympathy of the constitution with a local disease, is what I have called universal sympathy, and is, perhaps, the most simple act of a constitution; it is the sympathy, with a simple violence, as a cold, etc. but still it will vary in different constitutions, because all constitutions will not act alike under the influence of a local disease, although it will vary according to the stages of inflammation, according to



the natural disposition of the parts inflamed, and the situation of those parts in the body; yet it may be the most simple act of that constitution at the time; for although it would appear at the time to be an increase of the disease by its becoming universal, yet as it is a natural consequence, it is a much better sign of health, than if no fever had occurred in consequence of considerable injuries; for if there was no inflammation, there would probably be little or no fever. Nature requires to feel the injury, for where, after a considerable operation, there is rather a weak quiet pulse, often with a nervous oppression, with a seeming difficulty of breathing and a loathing of food, the patient is in a dangerous way. Fever shews power of resistance, the other symptoms shew weakness sinking under the injury. This is like the effects of the cold-bath; yet we see it calling forth, or rousing up to action, some peculiarity in the constitution, or a part, which may be continued after the sympathetic action is lost, and which may again reflect back upon the part its reluctance to heal. This may be exemplified by affection or injury, scrofula, even cancer, etc.<sup>i</sup>

<sup>i</sup> I believe that local specific irritations do not produce much variety in the constitution; for I am persuaded that specific local irritations are not capable of altering that constitution, similar to the plague and other contagious diseases.

Rigors are commonly the first symptom of a constitutional affection; but a rigor is productive of other effects, or symptoms, as it were naturally rising out of the rigor; and these are according to the nature of the constitution: in a strong constitution, a hot period succeeds, as if the constitution was roused to action to resist debility, which terminates the rigor; and this hot fit terminates in perspiration, which is the complete action of the disease, restoring tranquillity, which is the cure; and is the best termination that can happen where a rigor takes place; for it shews that the constitution has the power of terminating the effects of the cause. I believe, however, that in most cases it shews a degree of weakness, especially if easily excited, or a peculiarity of constitution. But as the cause is still continuing in cases of rigor arising from local irritation, these rigors

I believe that morbid poisons do not act by any peculiar mode of action in the part, so as to affect the constitution in any peculiar way, but such as are capable of continuing so long as to weaken that constitution, as, for instance, the lues, when of long standing; but this will be similar to every other lasting disease; for at first it certainly does not affect the constitution so as to alter the disposition of a wound made upon any part. I am not so certain respecting natural poisons. The tecuna, poisoned arrow, etc. would seem to produce a peculiar constitutional affection, from a local cause; for we can hardly suppose absorption to have taken place in so short a time.

may recur; and if they recur, it shews a constitution ready to be affected; however, if they do recur at stated periods, it still shews the constitution to be able to resist the effects of the disease. Further, if the constitution is weak, a rigor comes on, and no hot fit succeeds, but it runs directly into the sweat; it will probably be cold and clammy. If it is a constitution of another kind, the hot fit will continue, having only a kind of abatement, but no sweat or perfect intermission will take place, and therefore the whole action has not taken place.

Rigors from local irritation, attended with the full action, and at regular stated times, have all the characters of an intermittent fever; but it may be observed that, in common, rigors preceding suppuration are not followed by so much heat and sweating as an intermittent is.

In spontaneous inflammations, it is not so easy to ascertain, whether the constitution or the part is first affected, and if it always could, it would be the best guide to know whether the inflammation was local entirely, or an effect of a constitutional affection; nothing but the priority of the symptoms can in some degree fix this; but the constitutional symptoms are often so slight, at least at first, as not to be taken notice of. However, we know that indisposi-

tions of the constitution are productive of local complaints, which are often attended with inflammation, but which is often according to the nature of the parts,<sup>k</sup> the constitution being first diseased; and we know that in many fevers there is suppuration in some part of the body, and often in particular parts, such as the parotid glands, probably according to the nature of the fever; such inflammations will, according to their violence, add to the constitutional affection. Constitutional affection arising from inflammations will be almost coeval with the inflammations, or at least will very soon follow; however, that will be according to the circumstance before related; for inflammation is an act of the part, attended with a degree of violence, and the constitution will feel it sooner or later, according to circumstances. We see in cases of inflammation of the testicles from a gonorrhœa, (which must be considered as entirely local) that the constitution is soon affected by it. But constitutional symptoms arise from external violence alone, and more especially

<sup>k</sup> Local inflammations arising from derangement of the constitution, I think, are most commonly of the scrofulous kind, more especially when in parts of a particular nature, such as lymphatic glands, ligamentous or tendinous parts, which, when in particular situations, are often supposed to be venereal. Vide Treatise on Venereal Disease.



when attended with loss of substance; and they will be sooner or later, according to the degree of the violence, and the importance of the parts lost, agreeably to what has been said; but simple violence, even with the loss of a part, I have already observed, is not of such consequence as we should at first imagine; for in consequence of the loss of a limb, if the parts are allowed to heal by the first intention, the constitution is but little affected: it is, therefore, violence with loss of substance, and which is to produce inflammation and suppuration, that gives rise to the constitutional symptoms; and when these commence, or, more probably, when the parts set about these operations, the constitution becomes affected. It is more the new disposition in the parts, than the quantity of inflammatory action in them, by which the constitution is affected; for we shall see, that upon the simple commencement of the suppurative disposition, before it has taken place, rigors, etc. come on.

The constitutional effects arising upon the commencement of inflammation independent of situation, of vital parts, nerves, etc. are greater or less according to the nature of the disease. When the adhesive stage commences, it has but very little effect upon the whole system; there is sometimes, however, a rigor, although not

always; this is more in common spontaneous inflammations than in those arising from an injury done to a part, but such are seldom or ever alarming. When the suppurative disposition takes place, new effects upon the constitution arise, which are very considerable and varying in themselves. The cold fits, or rigors, are more frequently felt at the commencement of the suppurative than at the beginning of the adhesive inflammation, more especially too if it is what we commonly call spontaneous inflammations, which advance to suppuration; for in those inflammations occasioned by an accident, or an operation, which must suppurate, they appear to set out at the very first with a kind of suppurative disposition. Those arising in consequence of spontaneous inflammation, or from an injury, are not lasting, are often succeeded by hot fits, and if they terminate in perspiration then the patient is relieved; and are more or less so according to the greatness of the present inflammation and the suppuration that is likely to follow, joined to the nature of the parts and their situation: if in vital parts they will be most violent, and next to these, in parts far from the heart. This cold fit is, indeed, a constant symptom in most local diseases, which affect the constitution; and in this case, plainly shews that the constitution is

so affected, or sympathizes with the part. It is thus also, that fevers usually commence; and upon the absorption of any poisonous matter the same symptoms appear. I have seen them arise from a simple prick in the end of a finger, made with a clean sewing needle,<sup>1</sup> exactly similar to those arising from the absorption of poison. Disagreeable applications to the stomach produce them, and also disagreeable affections of the mind: but rigors are not confined to the commencement of disease, for they occur in its progress, and sometimes at its termination, as will be mentioned.

It is probable that the stomach is the cause of those rigors, by its taking part in the diseased action of the constitution; for as the stomach is the seat of simple animal life, and thereby the organ of universal sympathy of the *materia vitæ*, or the living principle, it is of course more or less affected upon all these occasions; so that an affection of any part of the body and of the mind, can produce very nearly the same effect as that which arises from disagreeable applications to the stomach itself; which accounts for that viscus taking part in all constitutional affections. I am inclined to believe, that sym-

<sup>1</sup> Hence it would seem as if simple irritation in a part, was capable of affecting the whole nervous system.

pathy of the stomach which occasions sickness, arises from causes producing weakness or debility. It takes place from injuries or disorders of the brain, which occasion universal debility; it arises from loss of blood, and also from epileptic fits. How far the sickness is to be considered as an effect which is to produce action, viz. vomiting, and which action is to reflect strength back upon the constitution, I do not know; but it is certain, that people who are sick, and going to faint, are prevented by the action of vomiting; the act of vomiting, therefore, appears often to be a cause of the prevention of the fits coming on, by rousing up the actions of life. The rigors I should be apt to suspect arise from weakness at the time. A sudden alteration, a sudden call, or a sudden and universal irritation upon the constitution, will, I imagine, produce immediate weakness; for every new action in a constitution, must produce, or tend to produce a weakness in that function; the effects of which will vary according to the necessity, and state of the constitution. In some cases where the constitution is strong, and as it were equal of itself to the task, it will call up the animal powers to action, and produce the hot fit of a fever; but in weak constitutions, or in such as threaten dissolution, as in many diseases, especially towards the close, it loses by



every rigor, and is seldom capable of producing a hot fit, but only occasions a cold clammy sweat; hence, cold sweats, when a person is in extremities, is a common symptom. That rigors are an effect of every sudden change in the constitution, and are not peculiar to the commencement of disease, is evident from the following cases; which also prove, that even the change to health shall produce the same effect, so that not only in its commencement, and in its different stages, a disease shall produce rigors, but in its termination or crisis.

A boy about eleven months old was taken ill with a complaint which could not be well understood from the symptoms, and which came on insensibly. His pulse was quick and full, for which he was bled three times, and the blood was rather sizzly; the tongue was white; he was not very hot, but uneasy and restless, with loss of appetite. His stools were upon the whole pretty natural; he was observed to be every other day rather worse, although there never was a perfect intermission, but only a kind of remission. After having been ill for about a fortnight in this way, he was taken with a cold shivering fit, succeeded by a hot fit, and then a sweat. My opinion was, that the disease was now formed, and that he would have more at the intermitting times; but he had no more

after. In short, the disease formed itself into that which has but one fit, and in this formation he had those symptoms. I have seen the same symptoms in many diseases, especially those occasioned by an operation, which in general alarm, but which should not if they go through their stages. A patient of mine at St. George's Hospital was cut for the stone; he had no uncommon symptoms for several weeks, when he was taken with a cold fit, which was succeeded by a hot one, and then by a profuse sweat. The young gentlemen of the hospital were rather alarmed, conceiving them to be the signs of dissolution; but I told them, that this was of no consequence, as the disease had completed its full action. That it was either a regular ague, or arose from the irritation of the wound; and if the first, he would have more of them at stated periods, which the bark would probably cure; but if the second, it might not return; for, since the constitution was in possession of the complete action, that when the parts got better he would be well. He had no more; and went on doing as well as if no such fit had ever taken place. This is not the only instance of this nature.

Here it is to be considered, that those affections of the constitution are effects of the local action of the solids, either when produced

by spontaneous causes, or by accident; but there are sometimes constitutional symptoms, or universal sympathies, which arise immediately out of the act of the violence itself, and which are often dangerous. Loss of blood may be reckoned one cause which will bring on all kinds of constitutional complaints, in consequence of weakness being produced, either immediate, as fainting, or secondary, as in dropsies, as well as nervous affections; the locked jaw, for instance; or violence alone without the loss of blood, may often produce immediate fatal effects.

I have seen a man thrown into such convulsions from the operation of the hydrocele being performed upon him, that I began to despair of his recovery. I have known a man die immediately of castration. These symptoms are somewhat similar to the second, or nervous, but are still very different; for in the present, the persons are as it were lost to themselves, being rendered senseless, therefore, it is probably more an affection of the brain than the nerves.

Another symptom attending inflammation when it has affected the constitution, is frequent exacerbations, or periods in which the inflammation appears to be increased. They have

great affinity to the rigors we have been mentioning.

Exacerbations are common to all constitutional diseases, and would often appear to belong to many local complaints. They are commonly regular if the constitution is strong, having their stated times, and in proportion as they are so the disease is less dangerous. They are a repetition of the first attack, but seldom so strong, except where there is a perfect cessation in the disease between the fits. This is an attribute belonging to life, and shews that life cannot go on the same continually in any state, but must have its hours of rest, and hours of action.

In this, as in almost every other symptom of disease, the effect has been considered as a cause, for exacerbations have always been considered as owing to the disease having its time of subsiding, or lessening, and its time of increase. This idea might pass as just in fevers where causes are not known; but where the causes continue the same, as in local diseases, we, *à priori*, should not expect it; yet we find in such cases periods of increase, and decrease of the symptoms, in the constitution, and therefore we must search after some principle belonging to animal life, as a cause of this.

We shall find that an animal is so constituted



as to be incapable of existing for any continuance of time in any one state whatever; the actions of the sensitive principle, when in perfect health, have their regular exacerbations, viz. watching, and sleep; it is disease that interrupts this regularity of the actions of health; therefore we find that the actions of disease cannot always go on in the same way; nature rests insensible of the disease, while the disease exists at all times alike: since this is the case, where we see evidently a continuance of the remote cause, and that the constitution is only capable of being affected by this cause at stated times; according to the species of irritation given, and the constitution at the time; may we not reasonably suppose this to be the case where the cause is invisible, as in fevers?

Whether these exacerbations are an effect of an occasional increase of the inflammation, or whether the inflammation is increased by the paroxysm of the fever, is not easy to determine; but they attend each other.

An ague is a disease which exists in the constitution, between the fits, as much as at the time of the fit; but the constitution becomes insensible of it, and the action can only last a stated time.

The process of ulceration seldom appears to

affect the whole system; it is hardly known to exist, but in the appearance of the parts, viz. when the part which contains the matter gets softer to the touch, or when an ulcer becomes larger. But that rigors take place upon the commencement of ulceration, I think is evident; although it cannot well be known in all cases; for ulceration will be so close upon suppuration in most cases, that it will be difficult to distinguish which was the cause of the rigor; but where suppuration has taken place, and the abscess is opened, so that the first act of suppuration is finished, yet if it is not opened so as to allow of a ready outlet to the matter, (for instance, if not opened at a depending part,) the pressure of the matter against the most depending part of the abscess will produce ulceration there, and rigors will take place. Those rigors, however, will not commence for some time after the first opening; because the first opening will for some time remove the disposition for ulceration all over the surface of the abscess: but when it finds that this opening is not sufficient to take off the pressure, then it sets about forming another opening, and when it does so, the rigors will recur, and with as much severity as before. This is supposed by some to be new matter forming from fresh inflammation, and by others to be the absorption of matter already

formed. Although ulceration does not affect the constitution equal to the mischief it is doing, yet its operations are often much affected by indispositions of the constitution; in some indispositions its progress is increased, in others it is even brought on, as in many old sores, especially of the lower extremities; and in some indispositions its progress is lessened or stopped.

The constitutional symptoms arising from a local complaint may be divided into three as to time, the immediate, the indefinite, and remote. Of the first, or immediate, there appears to be but one; of the second, there is probably a great variety, at least, appearing in very different forms and at very different periods, in respect of the original cause; of the remote there is probably only one. The immediate I shall reckon that which is called, the symptomatic fever; and what I shall reckon the second are, nervous affections, as spasms, both temporary and permanent, and delirium. Whether the symptomatic fever, the spasms, or the delirium, come first, is not certain, for often all concur or occur at the same time; but as the sympathetic fever is most constant, and is more an universal principle, it is to be reckoned the first. And the third, which I have called, remote, is what is understood by the hectic; to which

may be added the symptoms of dissolution, which is the last stage of all, and may be a consequence of either the above, or any other disease.

The first of the constitutional affections is commonly called, the symptomatic fever; but which I choose to call the sympathetic inflammatory fever. This is immediate, or nearly so, and is the sympathy of the constitution, with the first stages of a local disease, which excites an alarm in the constitution, thereby rousing up its powers to produce succeeding actions. This would appear to show very much the nature of the constitution at the time; for not being of any specific nature, both inflammation and fever are led of course into the nature of the constitution by the natural tendency of the constitution itself, and therefore partake of it, and only become more or less of a specific, in proportion as the constitution has more or less of a specific susceptibility or disposition.

I have already observed, that affections of the constitution often commence with rigor. However, the commencement of the sympathetic fever is not always attended with that effect; and I believe it is the best constitution where it is not; and in that case, it changes into a regular fever of the inflammatory kind. If the



constitution has powers, heat comes on, attended with dry skin, frequent and commonly a full pulse, having at the same time a degree of hardness in the stroke; watchfulness, high coloured urine, loss of appetite for solids, and thirst; all these will vary according to various visible circumstances, as well as according to many invisible ones, some one symptom being more in one constitution, and less in another.

It is in many instances difficult to determine what is cause, and what is effect. It has been commonly supposed that this fever was necessary for the operation of suppuration, and therefore the fever did not arise from the sympathy of the constitution with a local injury, but as a necessary effect to become a cause of suppuration. If this was the case, we could have no suppuration which had not been preceded by fever; and the fever must have been equal in all cases in the same constitution, let the quantity of injury be what it will. For if a pimple, or the suppuration of a scratch depended upon fever, they would require as much fever for their production of inflammation and suppuration as the largest abscess, or largest wound; for a point that inflames and suppurates is under the same predicament with respect to the whole that a thousand are; and a large abscess is to be considered as only made up of a thousand points.

One venereal sore requires as much mercury to cure it as a thousand. One plant requires as much wet weather and sunshine as a million. A principle that affects universally can only affect a part in proportion to the quantity of the universal affection there is in the part; each part has just its portion of general influence.

Now, according to this proposition, which is undeniable, a scratch requires the same quantity of fever that an amputation of the thigh does. Let us see how this accords with common experience; we find that inflammations and suppurations of sores shall take place without any fever; that the fever, in consequence of an injury, is not in all cases in the least proportioned to the quantity of injury, inflammation, and suppuration, which it always should, if the last was an effect of it; and we know if an increase of fever comes on, superadded to the sympathetic, that suppuration is retarded or stopped altogether, instead of being quickened.

From the same mode of reasoning it should be exactly the same whether the fever produce suppuration in a vital part or not a vital part. It is much more easy to conceive that an injury done to a vital part shall be the cause of universal sympathy, than that a vital part should require more fever to make it inflame and suppurate than a part does which is not vital.

This theory would at once upset our observation that the constitution is affected or sympathizes more readily with some parts than with others. In many cases of spontaneous inflammations and suppurations it was natural to suppose that the fever was the cause of the suppuration; but if persons who thought so had observed accurately, they would have divided spontaneous suppurations into two kinds; one, whose remote and immediate cause was local, and therefore in such the fever followed the local action, as in injuries; the other, where the remote cause was fever, which produced the injury; and the injury, whatever it was, produced the inflammation and suppuration; so that here fever preceded, and was necessary for the remote cause, but not as the immediate; and indeed, as a proof of this, suppuration hardly takes place till the fever is gone. The small-pox is of this last kind; as probably many other contagious diseases.

Those symptoms continue more or less, according to the degree of injury, the nature and situation of parts, and the constitution; but as they arise from a local cause, which subsides, they of course subside also; however, as the constitution has often an inflammatory tendency, or a tendency to some other disease, besides the action arising from the violence singly, the parts

often run into it, and this is reflected upon the constitution, which passes into that action to which it has a tendency, by which fever is kept up, and thereby inflammation.

The subsiding of these symptoms is the cure; and where they are simply the effects of the violence, the fever cures itself; therefore, the only thing necessary is to lessen its violence; but if the injury is of any specific kind, that specific quality must be corrected, if possible, and then the cure will take place.

As the motion of the blood in the whole system is increased, and as we have reason to suppose it is locally increased, then what will diminish the motion of the blood, will relieve in this respect; there are two methods of doing this; the first, by taking off its force; and this will be effected by bleeding.

This, if it does not lessen its motion, or take off from the sympathy of the constitution, with the local disease, yet it lessens the momentum in the whole and in the part, which is taking off the effect of the excess of motion in the blood.

The other is diminishing the action of the parts by affecting the constitution, which may be done by purging; in this light, bleeding may also be in some degree considered. It becomes in such cases very necessary to relieve the constitution by lessening the action of that con-



stitution; for although what has been advised, was to lessen the inflammation itself, and thereby lessen its effects on the constitution, yet as that seldom is done sufficiently to remove any affection of the constitution, we must therefore pay attention to that constitution; the two remedies will in some degree go hand in hand, one assisting the other; for instance, in a strong healthy constitution, where the symptomatic fever runs high, bleeding and purging will have their double effects; but still the constitution may require its peculiar medicines, which will in a secondary way relieve the inflammation.

The secondary constitutional symptoms are not so determined as to time; I have called them nervous, although not strictly so in every case, because more variety of affections are produced than from any cause I know; yet these affections seem all to have more connexion with the nervous than the vascular system, and are severally excited by the particular tendency or susceptibility of different constitutions. Many of them, I believe, are more common to the young than the old, which come under the doctrine of universal nervous sympathy, with a local complaint; of this kind are universal convulsions from teething or worms; local convulsions, as St. Vitus's dance, and probably many others not so well marked, as those which

worms and teething often produce. I have seen hickup come on early in consequence of an operation; but in this stage of the nervous affection, little was to be apprehended, although it certainly shewed a peculiarity of constitution, and such as should be attended to; but when hickup occurs towards the last stages, it shews strong signs of dissolution.

Many full-grown persons are also subject to very severe affections of the nervous kind, especially those people who are called nervous; and more particularly still those who have bad affections, in consequence of complaints of the stomach. In such constitutions there is observed great dejection, sinking, cold sweats, hardly any pulse, loss of appetite, no sleep, etc. seeming to threaten dissolution; those symptoms are worse by fits. Delirium appears to arise from nervous affection of the brain, or sensorium, producing a sympathy of the action of the brain, with the *materia vitæ* of the parts; not sensation as a head-ach, but action, producing ideas without the exciting impression, and therefore delusive. This symptom is common to them all; it is frequently a consequence of their being violent, or carried to considerable length in their several kinds: often arising in consequence of compound fractures, amputation of the lower extremities, injuries done to joints, brain, etc. but

not so often attending the hectic, although it is often a symptom of dissolution. We have agues also from many diseases of parts, more especially of the liver, as also of the spleen, and from induration of the mesenteric glands.

The following cases are remarkable instances of well-marked constitutional diseases from local irritation, where the constitution took on a particular action, to which it had a strong tendency. A gentleman had a very bad fistula in perinæo from a stricture, and when the water did not come freely, an inflammation in the part and scrotum was produced, and then he had an ague, which was relieved for a time by the bark. Two children had an ague from worms, which was not in the least relieved by the bark, but by destroying the worms they were cured.

As these diseases which I have brought into this class are of such various kinds, each must be taken up apart, and treated accordingly; but they are such as yield very little to medicine, for in some the constitutional disease is formed, and does not require the presence of the local disease to keep it up, as in the tetanus; and in others, the local disease being still in force, it is not to be expected that the constitutional affection is to be entirely relieved, although in some degree it may. In those which form a regular constitutional disease, such as an ague,

although the local diseases may still exist in full force, yet some relief may be expected; the bark is to be administered, although not with a view to cure, as the immediate cause still exists; but bark will in some lessen that susceptibility in the constitution, and may cure at least for a time, as I have seen in agues arising from the fistula in perinæo. But the susceptibility in the two children, cited above, was so strong for such a disease, that the bark was not sufficient; and therefore, when the local cause is not known, and when the common remedies for such effects do not cure them, some local disease should be suspected. We see often such symptoms arising from diseases of the liver, and the bark curing this symptom, yet the liver shall go on with its disease, and probably faster, as I believe bark is not a proper medicine for diseases of this viscus; such complaints of the liver have been too often attributed to the curing of the ague improperly by bark. St. Vitus's dance, and many other involuntary actions, have arisen from the same cause; such constitutions required only an immediate cause to produce the effects. It is possible, however, that no other mode of local irritation would have produced the same effect, every constitution having a part that is capable of affecting it most. We find also local effects in



consequence of local injuries, as the locked jaw, etc. which are remote sympathies with the part affected, which may become pretty universal, and which cannot be called immediate effects as to time, as they are often forming after the sympathetic fever has taken place, especially the locked jaw, which appears in many cases to be formed in the time of the preceding disease, and not appearing till it has subsided. There are certain intermediate steps between the inflammatory and the hectic state; but neither cure nor dissolution take place in this period.

The following case illustrates the effects of inflammation on the constitution.

A lady, of what is called a nervous constitution, arising in some degree from an irritable stomach, often troubled with flatulencies, and what are called nervous head-aches, with pale urine at those times, uncomfortable feelings and often sinkings, had a tumour removed from the breast, and likewise from near the arm-pit; nothing appeared uncommon for a few days, when very considerable disorders came on. She was attacked with a shivering or cold fit, attended with the feel of dying, and followed with cold sweat. It being supposed that she was dying, brandy was thrown in, which soon brought on a warmth, and she was relieved; the

fits came on frequently for several days, which were always relieved by brandy; and she took in one of the most violent of them about half a pint of brandy.

While under these affections she took the bark as a strengthener; the musk, occasionally, as a sedative in pretty large quantities; camphorated julap frequently, as an antispasmodic; and towards the last she took the valerian in large quantities: but whatever effect these might have in lessening the disease on the whole, they were certainly not equal to it without the brandy. Brandy removed those dying fits, and I thought they became less violent after taking the valerian.

A question naturally occurs; would the brandy alone, if it had been continued as a medicine, have cured her, without the aid of the other medicines? The other medicines, I think, certainly could not have done it; nor do I believe that the brandy could have been continued in such quantity as to have prevented their returns; if so, then the two modes were happily united, the one gradually to prevent, the other to remove immediately the fits when they came on. This case, from the general tenor of the constitution, was running with great facility into the hectic.

## CHAPTER V.

*OF PUS.*

**H**ITHERTO I have been treating of the operations of parts, preparatory to the formation of pus; I am now come to the formation of that fluid, its nature and supposed uses.

The immediate effect of the mode of action above described, is the formation of a fluid, commonly termed pus; this is very different from what was discharged in the time of the adhesive stage of the inflammation, when either formed in the cellular membrane or circumscribed cavities; it is also very different from the natural secretion of internal canals, though it is probably formed in both by the same vessels, but under very different modes of action.

The cellular membrane, or circumscribed cavities, have their vessels but little changed from the adhesive state at the commencement of the suppurative disposition; so that they still retain much of the form they had acquired by the first state, the discharge being at the beginning little more than coagulating lymph mixed

with some serum. This is scarcely different from the adhesive stage of the inflammation; but as the inflammatory disposition subsides, the new disposition is every instant of time altering those vessels to their suppurative state; the discharge is also varying and changing from a species of extravasation to a new formed matter peculiar to suppuration; this matter is a remove further from the nature of the blood, and becomes more and more of the nature of the pus; it becomes whiter and whiter, losing more and more of the yellow and green, which it is apt to give the linen that is stained with it in its first stages, and in consistence more and more viscid, or creamy.

By the formation of this new substance, the coagulating lymph, which was extravasated in the adhesive state of the inflammation, and adhered to the sides of the cells, either in cut surfaces as in wounds, in abscesses, or circumscribed cavities, is pushed off from these surfaces, and if it is the inner surface of a cavity, it is pushed into it, so that the cavity contains both coagulating lymph and pus; or if it is a cut surface, the coagulating lymph is separated from it by the suppuration taking place, and is thrown off; but as such surfaces are generally dressed immediately after the operation, while the wound is bleeding, this blood unites the dressings to



the sore, which is assisted afterwards by the coagulating lymph thrown out in the adhesive stage; the whole, viz. dressings, blood, and coagulating lymph are generally thrown off together, when suppuration commences on these surfaces. This is the process which takes place in the first formation of an abscess, and the first process towards suppuration in a fresh wound.

Upon the internal surfaces of the canals, the parts do not go through all those steps; they would appear to run into suppuration almost instantaneously; however, inflammations even here is a kind of forerunner of suppuration. This discharge, from internal canals, has never been reckoned true matter, it has been called mucus, etc. but it has all the characters of true pus which I am yet acquainted with.

Pus is not to be found in the blood, similar to that which was produced in the first stage; but is formed from some change, decomposition, or separation of the blood, which it undergoes in its passage out of the vessels, and for effecting which, the vessels of the parts have been formed, which produces a subsiding of the inflammation from which it took its disposition; hence it must appear, that the formation of pus consists of something more than a straining of juices from the blood. Many substances indeed

which are to be considered as extraneous bodies in the blood, being only mixed with, and not making an essential part of that fluid, and perhaps even unnecessary to it, may pass off with the pus, as with every other secretion, yet the pus is not to be considered on that account as simply parts of the blood unchanged; but we must look upon it as a new combination of the blood itself, and must be convinced, that, in order to carry on the decompositions and combinations necessary for producing this effect, either a new or peculiar structure of vessels must be formed, or a new disposition, and of course a new mode of action, of the old must take place. This new structure, or disposition of vessels, I shall call glandular, and the effect, or pus, a secretion.

### I. *Of the General Opinion of the Formation of Pus.*

THE dissolution of the living solids of an animal body into pus, and that the pus already formed has the power of continuing the dissolution, is an old opinion, and is still the opinion of many; for their language is, "Pus corrodes, it is acrid, etc." If this idea of theirs was just, no sore which discharges matter could be exempted from a continual dissolution; and I think it must ap-

pear inconsistent, that the matter, which was probably intended for salutary purposes, should be a means of destroying the very parts which produced it, and which it is meant to heal. Probably they took their idea from finding, that an abscess was a hollow cavity in the solids, and supposing the whole of the original substance of this cavity was now the matter which was found in it. This was a very natural way of accounting for the formation of pus, by one entirely ignorant of the moving juices, the powers of the arteries, and the operation of an abscess after it was opened; for the knowledge of these three, abstracted from the knowledge of the abscess before opening, should have naturally led them to account for the formation of pus from the blood by the powers of the arteries alone; for upon their principle these abscesses should continue to increase after opening, as fast as before. Upon this principle being established in their minds, viz. that solids were dissolved down into pus, they built a practice which was to bring all indurated parts to suppuration if possible, and not to open the suppuration in such parts early; this was done with a view to give such solids time to melt down into pus, which was the expression; but, according to their own theory, they seemed to forget that abscesses formed matter after opening, and

therefore the parts stood the same chance of dissolution into pus as before. Also, from being possessed of this idea, that solids went into the composition of pus, they never saw pus flowing from any internal canal, as in a gonorrhœa, etc. but they concluded that there was an ulcer. We would forgive such opinions, before the knowledge that such surfaces could and generally did form pus without a breach of the solids; but that such an opinion should exist afterwards, is not mere ignorance, but stupidity; and the very circumstance of internal circumscribed cavities, as the abdomen, thorax, etc. forming pus, where they might often have seen pints of matter, and yet no breach in the solids to have produced it, which is a proof beyond controversy, should have taught them better; such ideas discover defect of knowledge and incapacity for observation.

The moderns have been still more ridiculous, for knowing that it was deried, that solids were ever dissolved into pus, and also knowing that there was not a single proof of it, they have been busy in producing what to them seemed proof. They have been putting dead animal matter into abscesses, and finding that it was either wholly or in part dissolved, they therefore attributed the loss to its being formed into pus; but this was putting living



and dead animal matter upon the same footing, which is a contradiction in itself; for if the result of this experiment was really according to their idea of it, the idea of living parts being dissolved into pus must fall to the ground, because living animal matter and dead animal matter can never stand upon the same ground.

Common observation in their profession should have taught them, that even extraneous animal matter would lie in abscesses for a considerable time before it was even dissolved. They might have observed in abscesses arising either from violence, or from a species of erysipellatous inflammation, that there were often sloughs of the cellular membrane, and that those sloughs would come away like wet tow, and therefore were not dissolved into pus.

They might also have observed in abscesses on tendinous parts, as about the ankle, etc. that often a tendon became dead and sloughed away, and that these sores do not heal till such parts have sloughed, and this is often not accomplished for months, and yet all this time those sloughs are not formed into pus. They might have also known, or observed, that pieces of dead bone shall lie soaking in matter for many months, and yet not dissolve into pus; and although bones in such situations shall lose con-

siderably of their substance (which might by the ignorant be supposed to have been dissolved into pus) yet that waste can be accounted for and proved on the principle of absorption; for they always lose on that surface where the continuity is broke off, and which is only a continuation of the separating process.<sup>a</sup> To see how far the idea was just, that dead animal matter was dissolved by pus, I put it to the trial of experiment, because I could put a piece of dead animal matter of a given weight into an abscess, and which could at stated times be weighed; to make it still more satisfactory, a similar piece was put into water, kept to nearly the same heat: they both lost in weight, but that in the abscess most, and there was also a difference in the manner, for that in the water became soonest putrid; but these experiments having been made as far back as the year 1757, I shall not rely on their accuracy, but state them as made by my brother-in-law, Mr. Home, and as given in his Dissertation on the Properties of Pus, page 32, under the idea that pus had a corroding quality.

“ As pus has been supposed to have a cor-

<sup>a</sup> It may be supposed that bones are not capable of being dissolved into pus; but we know that bone has animal substance in it, and we also know that this animal substance is capable of being dissolved into chyle.

roding quality," I may add even upon the living solids, "I made the following experiments, to ascertain the truth or fallacy of such an assertion, and found it to be void of foundation, and to have arisen from the inaccuracy of observers having prevented them from seeing the distinctions between pus in a pure state, and when mixed with other substances.

" EXPERIMENT.

"I made a comparative trial upon matter contained in an abscess, and on pus and animal jelly out of the body. The matter and jelly were in equal quantities and contained in glass vessels, kept nearly in the temperature of the human body. To make the comparative trials as fair as possible, a portion of muscle, weighing exactly one drachm, was immersed in the matter of a compound fracture in the arm of a living man, and a similar portion into some of the same matter out of the body; also a third portion into fluid calf's foot jelly, in which the animal substance was pure, having neither wine nor vegetables mixed with it. These three portions of muscle were taken out once every twenty-four hours, washed in water, weighed and returned again. The results were as follows:  
"In twenty-four hours.—The portion of muscle in the abscess weighed sixty-grains, was

pulpy and soft, but quite free from putrefaction: that portion immersed in the pus, weighed forty-six grains, was pulpy, soft, and had a slightly putrid smell: the portion in the jelly weighed thirty-eight grains, was smaller and firmer in its texture.

“Forty-eight hours.—The portion of muscle in the abscess weighed thirty-eight grains, and had undergone no change: that in the matter weighed thirty-six grains, was softer and more putrid: that in the jelly thirty-six grains and smaller.

“Seventy-two hours.—The portion of muscle in the abscess weighed twenty-seven grains, was drier and firmer: that in the matter eighteen grains, and was rendered fibrous and thready: that in the jelly unaltered.

“Ninety-six hours.—The portion of muscle in the abscess weighed twenty-five grains: that in the matter was dissolved: that in the jelly weighed thirty-six grains.<sup>b</sup>

<sup>b</sup> One reason, probably, for the piece of meat so soon becoming putrid and dissolving in the pus, was its being kept in the same pus the whole time; therefore its dissolution was owing more to putrefaction than a dissolving quality in the pus; whereas the piece in the abscess had its matter continually changing, which is the common result in a sore, and if it had a corroding quality independent of the putrefaction, it ought to have been dissolved first; but we may observe, that the



“ One hundred and twenty hours.—The portion of muscle in the abscess weighed twenty-two grains, not at all putrid: that in the jelly thirty-four grains, not at all putrid.

“ One hundred and forty-four hours.—The portion of muscle in the abscess weighed twenty-two grains, and was free from putrefaction; that in the jelly thirty-four grains.”

The supposed facts of the solids dissolving being established in the mind as so many data to reason from, they had now no difficulty to account for the formation of pus from both the solids and the fluids; fermentation started up in the mind immediately as a cause; but there must be a cause for fermentation; and according to this idea, there are facts which go against it: first, let us consider internal canals, where only mucus is naturally formed, taking on the formation of pus without the loss of substance, or any previous ferment, and leaving it off.

Now if a fermentation of the solids and fluids was the immediate cause, I should beg leave to ask what solids were destroyed in order to enter into the composition of the pus discharged; for the whole penis could not afford matter enough to form the pus, which is dis-

piece of muscle in the abscess, and the piece in the jelly were nearly upon a par.

charged in a common gonorrhœa; I should also beg leave to be informed how that fermentation of the fluids ever ceased, for there is the same surface, secreting its mucus, whenever the formation of pus ceases.

Besides, if dissolved solids enter necessarily into the composition of pus, by the power of some ferment, it may be asked by what power the first particle of this fluid in an abscess or sore is formed, before there is any particle existing which is capable of dissolving the solids?

An abscess shall form, and suppuration ceasing, it shall become stationary, perhaps for months, and at last be absorbed, and the whole shall heal; what becomes of the ferment the whole time it is stationary?

It has been supposed that blood when extravasated becomes of itself pus; but we find blood, when extravasated, either from violence or a rupture of a vessel, as in an aneurism, never of itself becomes pus; nor was pus ever formed in such cavities till inflammation had taken place in them, and that in such cavities there was to be found both the blood and the matter; if the blood had coagulated (as it seldom does in those cases of violence) it would be found still coagulated, and if it had not coagulated the pus would be bloody.

True pus has certain properties, which when taken singly may belong to other secretions, but when all joined, form the peculiar character of pus, viz. globules swimming in a fluid, which is coagulable by a solution of sal ammoniac, which no other animal secretion that I know is; and at the same time a consequence of inflammation; these circumstances taken together may be said to constitute pus.

As inflammation does not produce at first true pus, I made the following experiments to ascertain its progress or formation. To do this it was only necessary to keep up an irritation on some living part a sufficient time to oblige it to set about the natural consequent actions, and the smooth coat of an internal cavity appeared to me to be well calculated for such an experiment, where nothing could interfere with the actions of the parts, or their result, and it would also show its progress on internal surfaces, which shows its progress in wounds and abscesses.

## II. *Experiments to ascertain the Progress of Suppuration.*

### EXPERIMENT I.

THE tunica vaginalis of a young ram was opened and the testicle exposed. The surface

of the testicle was wiped clean, and a piece of talc was laid upon it. The surface almost immediately became more vascular; five minutes after, the talc was removed and examined in a microscope, but no globules could be observed, only a moisture which appeared to be serum. Ten minutes after, there were irregular masses formed on the talc, some transparent, with determined edges, but no globules: fifteen minutes after, nearly the same.

At twenty minutes, there was an appearance of globules.

At twenty-five minutes, there were globules in clusters; but I could not say exactly what those globules were.

At thirty-five minutes, the globules more distinct, more diffused, and numerous.

At fifty-five minutes, the globules still more perfect and distinct.

At seventy, the globules more irregular, and of course less distinct.

At eighty-five, the globules more distinct and numerous.

At one hundred, more irregular and less distinct, forming little masses.

At two hours, the masses more transparent, and the globules fewer.

At two hours and half, the masses transparent, and no distinct globules.



At four hours, some transparent masses appearing to contain globules.

At seven hours, distinct globules and numerous.

At eight hours, the globules more distinct and somewhat larger.

At nine hours, less appearance of globules.

At twenty-one hours, the testicle was covered with lint, and the skin brought over and kept together with a ligature, and allowed to remain for twelve hours, which, from the first, was thirty-three hours; when it was opened, it was wiped dry, and a piece of talc applied for five minutes; the quantity of fluid very small, but containing globules small and numerous.

N. B. In this time when the testicle was covered, there were strong adhesions took place between the testicles and tunica vaginalis, which shows that probably the inflammation moved back to the adhesive stage whenever two similar surfaces were opposed.

Forty hours, the above repeated and the globules a little more distinct.

Forty-four hours, the appearance of globules very distinct, and it looked like common matter diluted.

## EXPERIMENT II.

An opening was made through the linea alba below the navel, several inches long, into the cavity of the belly of a dog, care being taken that no blood should pass into that cavity; a piece of talc was applied to the peritoneum so as to be covered with the fluid which lubricates that surface; to do which, it was found necessary to draw it over some considerable surface: this fluid was examined in the field of the microscope, and appeared to contain small semi-transparent globules, few in number, swimming in a fluid.

The lubricating fluid in the cavity of the abdomen, appears, from repeated experiments on healthy dogs, to be so small in quantity as only to give a polish to the different surfaces, but not sufficient to have a drop collected.

After five minutes, the surfaces had more moisture upon them, which being examined as before, the globular appearance was more distinct.

In fifteen minutes, the surfaces were more vascular; a portion of intestine was wiped dry, and a piece of talc applied to it; the fluid collected on it had a great number of globules, which were smaller than those at first observed.

In an hour, this portion of intestine had its blood-vessels considerably increased in number; the whole surface appearing of an uniformly red colour: this was wiped dry and a piece of talc laid upon it; the fluid collected did not appear to be made up of globules, but of very small parts which had some transparency, but not exactly regular in their figure, which became still more evident on drying, when they lost the transparency altogether; these were most probably coagulating lymph.

This was repeated upon the surface of the spleen, which had its surface excessively red, from the increased number of small vessels carrying red blood, and the result was exactly similar.

From these experiments, the fluid which lubricates the peritoneum seems to undergo changes, in consequence of exposure, and at last, when inflammation takes place, to have coagulating lymph substituted for it.

Although the lubricating fluid of the peritoneum is so small in quantity in a natural state, yet before that cavity has been exposed for half an hour, the quantity is much increased, and has a mottled appearance of oil and water; but from the appearance in the microscope, it is only an increase of the original fluid with some

coagulating lymph, although mistaken by some anatomists for an oily lubricating liquor.

### EXPERIMENT III.

At half past seven o'clock in the morning, an incision was made with a lancet into the upper fleshy part of a young ram's thigh, into which was introduced a silver canula, about a quarter of an inch in diameter, and three quarters long, with a great number of small holes in the sides, and open at the bottom; it was fastened by means of ligatures to the skin, and a small cork adapted to it.

The blood was sponged out several times, and the cork kept in during the intervals. At half past nine the cork was withdrawn, and the canula was found to contain a fluid; a piece of talc was dipped in it, and the appearance was evidently globular, exactly like the red globules without the colour.

At eleven, the quantity of fluid much increased, and the same appearance.

At one, the quantity half filling the pipe, of a redish brown colour; the globules more numerous, without colour when diluted with water.

At three, the quantity considerable, the globules smaller, freer from colour.

At half past five, the same.



## EXPERIMENT IV.

In the same manner the canula was introduced into the fleshy part of an ass's thigh, at nine in the morning; and at one o'clock, as also at two, there was a fluid tinged with red globules.

At four, there were no diffused globules, but there appeared to be small flakes in a transparent fluid; however they proved to be clusters of globules.

At seven, next morning, which was twenty-two hours, there was found in the canula, common pus.

From the experiments on internal surfaces, it would appear that pus was formed coeval with its secretion; but from Mr. Home's experiments, page 51, it would rather appear that the globules were not formed till some time after secretion, and this sooner or later, according to circumstances, which we probably do not know.

So far these experiments explain the progress of suppuration on internal surfaces, and I shall now give its progress on the cutis, when deprived of its cuticle, from Mr. Home's Dissertation on that subject beforementioned.

"I applied a blistering plaister of the size of a half-crown piece to the pit of the stomach of a healthy young man. In eight hours a

blister arose, which was opened, and the contents removed; they were fluid, transparent, and coagulated by heat; had no appearance of globules, when examined by the microscope; and in every respect resembled the serum of blood. The cuticle was not removed, but allowed to collapse, and the fluid, which was formed upon the surface of the cutis, was examined from time to time by a microscope, to determine as accurately as possible the changes which took place.

“The better to do this, as the quantity in the intervals stated below must be exceedingly small, a piece of talc, very thin and transparent, was applied to the whole surface, and covered with an adhesive plaister; and the surface of the talc applied to the skin was removed and examined by the microscope, applying a fresh piece of talc after every examination, to prevent any mistake which might have arisen from the surface not being quite clean.

“The fluid was examined by the microscope, to ascertain its appearance; but as the aqueous part in which the globules of pus swim, is found by experiment to coagulate, by adding to it a saturated solution of sal ammoniac, which is not the case with the serum of the blood nor the transparent part of the milk, I considered this as a property peculiar to pus; and consequently

that it would be a very good test by which to ascertain the presence of true pus.

“ In eight hours.—From the time the blister was applied, the fluid discharged was perfectly transparent, and did not coagulate with the solution of sal ammoniac.

“ Nine hours.—The discharge was less transparent; but free from the appearance of globules.

“ Ten hours.—The discharge contained globules which were very small, and few in number.

“ Eleven hours.—The globules were numerous, but still the fluid did not coagulate with the solution of sal ammoniac.

“ Twelve hours.—The appearance much the same as before.

“ Fourteen hours.—The globules a little larger, and the fluid appeared to be thickened by a solution of sal ammoniac.

“ Sixteen hours.—The globules seemed to form themselves into masses; but were transparent.

“ Twenty hours.—The globules were double the size of those first observed at ten hours, and gave the appearance of true pus, in a diluted state: the fluid was coagulated by a solution of sal ammoniac, the globules at the same time remaining perfectly distinct, so that I should consider this as true pus.

“Twenty-two hours.—No change appeared to have taken place.

“Thirty-two hours.—The fluid was considerably thicker in consistence, the number of globules being very much increased: but in no other respect that I could observe, did it differ from that formed twenty hours after the application of the blister.”

To ascertain the progress of suppuration on canals, or secreting surfaces, I have often examined the matter on a bougie, that had been introduced into the urethra, and found it to be formed earlier than either of the times before-mentioned; Mr. Home's experiment makes it five hours; but we often find a gonorrhœa coming on at once, not having in the least been preceded by a leading discharge.

Since that period experiments have been made on pus, from different kinds of sores, with an intention to ascertain the nature of the sore by the result of such analysis. That sores give very different kinds of pus is evident to the naked eye, and that the different parts of which the blood is composed will come away in different proportions, we can make no doubt; and we find that whatever is in solution in the blood, comes away more in one kind of pus than another, which are all so many deviations from true pus; we may also observe, that such kinds



of pus change, after being secreted, much sooner than true pus, which will be observed by and by. From all this I should be apt to conceive, that such experiments will throw little light on the specific nature of the disease, which is the thing wanted. From such experiments we may find out that pus, from a venereal bubo in its height of malady, or that from a cancer, is bad matter, but cannot ascertain the difference between those two matters and all others, nor the specific difference between the two. The small-pox, although as malignant a disease as any, and one which produces a pus as replete with poisonous particles as any, yet gives a true pus, when not of the confluent kind, which disposition is not small-pox. The reason why it is good pus, is, because its inflammation is of the true suppurative kind; and the reason why it is of the true suppurative kind, is, because the parts have the power of curing themselves, just as much as in any accident which happens to such a constitution; but this is not the case with either the venereal disease or the cancer; from the moment these set out, their dispositions tend to become worse and worse; but the venereal bubo, if mercury is given so as to affect it, soon gives us another kind of pus, although this has the poison equally in it; therefore it is not the circumstance of containing a poison which

makes it what is called a bad pus, but its being formed from a sore that has no disposition to heal: as we cannot give healing action to a cancer, so we never can have a good pus. The observation respecting the small pox is applicable to the venereal gonorrhœa; for this complaint having the power of curing itself, its pus is good in proportion to that power; but as the periods of cure are not so determined as in the small-pox, neither is its time in producing good pus so determined; but like the small-pox, as well as the venereal disease when it is healing, we have good pus, although it contains the poison.

From the above experiments it must appear unnecessary to give the chemical analyses of what is commonly called pus, for whatever comes from a sore has that name, although very different in many cases from what I should call true pus; and we shall find in those sores that have some specific quality which hinders them from healing, that the discharge is not pus. Probably the chemical properties may be nearly the same in them all.

## II. *Of the Properties of Pus.*

Pus, in the most perfect state, has at the first view certain peculiar qualities. These are

principally colour and consistence; but it appears that the colour takes its rise from the largest portion of the whole mass being composed of very small round bodies, very much like those small round globules which swimming in a fluid make cream: I should suppose those round globules to be white in themselves, as cream would appear to be; although it is not necessary that the substance of matter which reflects a white, should be itself white; for a vast number of transparent bodies being brought together will produce a white, such as broken glass, broken ice, water covering globules of air, making froth, etc.

These globules swim in a fluid, which we should at first suppose to be the serum of the blood, for it coagulates with heat like serum, and most probably is mixt with a small quantity of coagulating lymph; for pus in part coagulates, after having been discharged from the secreting vessels, as mucus is observed to do. But although it is thus far similar to serum, yet it has properties that serum has not. Observing there was a similarity between pus and milk, I tried if the fluid part of pus could be coagulated with the juice of the stomach of other animals, but found it could not. I then tried it with several mixtures, principally with the neutral salts, and found that a solution of sal ammoniac coagulated this fluid; not finding that a solution

of this salt coagulated any other of our natural juices, I concluded that globules swimming in a fluid that was coagulable by this salt was to be considered as pus, and would be always formed in sores that had no peculiar backwardness to heal.

The proportion that these white globules in the pus bear to the other parts depends on the health of the parts which formed it; for when they are in a large proportion, the matter is thicker and whiter, and is called good matter; the meaning of which is, that the solids which produced it are in good health; for these appearances in the matter are no more than the result of certain salutary processes going on in the solids, the effect of which processes is, to produce the disposition on which both suppuration and granulation depend; all this is a good deal similar to the formation of milk; for in the commencement of the secretion of this fluid, it is at first principally serum, and as the animal advances towards delivery, the globules are forming and become more in quantity, and the animal that has them in largest quantity has the richest milk; likewise when they are naturally leaving off secreting milk, it again takes an exact retrograde motion; and we may also observe, that if any local affection attacks this gland, such as inflammation, the milk is falling



back to the state I have been now describing; or if any constitutional affection takes place, such as fever, etc. then this gland suffers in the same manner.

Pus is specifically heavier than water; it is probably nearly of the same weight with blood or any other animal substance rendered fluid.

Pus, besides the abovementioned properties, has a sweetish and maukish taste, probably from having sugar in it, which is very different from most other secretions, and the same taste takes place, whether it is pus from a sore, viz. an ulcer, or an irritated inflamed surface. Thus, if any have an ulcer in their nose, mouth, throat, lungs, or parts adjacent, so that the matter shall come into the mouth unaltered by putrefaction, they will be able to taste it from its having this property; whereas the mucus and saliva of those parts is tasteless. The same thing happens when an irritation to inflammation takes place on the surface of those parts without ulceration.

If the internal surface of the nose is inflamed, when we blow it on a white handkerchief, we see the substance discharged of a yellow colour; we also find that when we draw up the same substance into the mouth, that it has a sweetish maukish taste. If it is the surface of the mouth or throat that discharge this

matter, the same taste is observable; and if it is brought up from the trachea and lungs, in consequence of the common effects of a cold on those parts, the same taste is also to be observed; so that pus, from whatever surface, whether an irritated natural surface, or the surface of a common sore, has this property.

Pus has a smell in some degree peculiar to itself; but this differs; some diseases, such for instance as the venereal gonorrhœa, it is pretended may be known by the smell.

To ascertain the properties of pus, or to distinguish it from mucus, it has, with mucus, been put to the test of chemistry. Solution in menstrua, and precipitation were thought to be a test of their distinction.

This principle in its very first appearance is unphilosophical, and was at the very first treated by me as absurd. I conceived that all animal substance whatever, when in solution, either in acids or alkalies, would then be in the same state, and therefore that the precipitation would be the same in all. Calcareous earth, when dissolved in an acid, (for instance, the muriatic) is in that acid in the same state, whether it has been dissolved from chalk, lime-stone, marble, or calcareous spar; and the precipitations from all are the same.

However, whatever my opinion might be,

yet bold assertions, the result of described experiments, made me avoid falling into the same error, of describing what I never had seen; I made, therefore, some experiments on this subject; and in consequence of having previously formed the abovementioned opinion, I was more general in my experiments. I made them on organic animal matter, as well as on inorganic, and the result was the same in all.

As organic animal matter, I took muscle, tendon, cartilage, gland, viz. liver and brain.

As inorganic animal, I took pus, and the white of an egg, and dissolved each in the vitriolic acid, and then precipitated the solution with vegetable alkali.

Each precipitation I examined with such magnifiers as plainly shewed the forms of the precipitate; all of which appeared to be flaky substances.

The precipitate by the volatile alkali, appeared exactly the same.

To carry those experiments a little further, I dissolved the same substance in the vegetable caustic alkali, and precipitated the solution with the muriatic acid, and examined each precipitate with the microscope, and the appearance was the same, viz. a flaky substance, without any regular form.

To see how far the nature of sores might be

ascertained from the nature of their discharge, matter from a cancerous sore has been analyzed, and the result has been, that such matter differs from true pus; but this explains nothing more than what the naked eye can perceive, that it is not pus; but it will not shew the specific difference between the matter from a cancer and matter from a venereal bubo, where mercury has not been given, nor will it tell that one is cancer and the other is venereal. We might as well analyze the urine at different times, in order to ascertain the nature of the kidneys at those times.

The quality of pus is always according to the nature of the parts which produce it; and whatever specific qualities the parts may have besides, the pus has also this specific quality; hence we have venereal matter from venereal sores, small-pox matter from small-pox sores, cancerous matter from cancerous sores, etc. It is not in the least affected by the constitution, except the parts which produce it are also affected by the constitution.

Pus is so far of the same specific nature with the part which produces it, that it does not become an irritator to that part; it is perfectly in harmony with it, the part is not in the least sensible of it; therefore the pus of a suppurat-



ing surface is not an irritator to the same surface, but may be an irritator to any other not of the same kind; hence, no suppurating surface of any specific kind can be kept up by its own matter, for if this had not been the case, no sore of any specific quality, or producing matter of an irritating quality, could ever have been healed. This is similar to every other secretion of stimulating fluids, as the bile, tears, etc. for those do not stimulate their own glands or ducts, but are capable of stimulating any other part of the body. The venereal gonorrhœa, small-pox, etc. healing or recovering of themselves, are striking instances of this; however, we find matter under certain circumstances stimulating its own sore, and also secretions stimulating their own canals, as the secretions of the intestines stimulating themselves; but how far this may not arise from one part of the intestines being so diseased, as to secrete a stimulating fluid, and coming to a sound part, stimulates that only, I will not determine. This I am certain happens to the rectum and anus; for it very often happens in purging, that the watery stools shall irritate those parts so much as to make them feel as if they were scalded. This idea seems reasonable on another principle; for when we consider matter in the gross, we shall

find that it is often mixed with extraneous substances which make no part of it, being probably strained from the blood; and also, probably, undergoing a change afterwards from its not being pure pus; nor do these always arise entirely from the nature of the sore, for they are produced by sores of very different specific qualities, it being the species of matter itself which arises from the nature of the sore; however, the kind of sore will often produce more or less of this extraneous matter, and this additional substance may act as a stimulus on every kind of sore.

What I have considered thus far, is the natural process of a sound constitution and sound parts; since a sore that is going through all the natural stages to a cure, is not to be called a disease.

A proof of this is, that whenever a real disease attacks either the suppurating surface, or the constitution, these processes of nature are destroyed, and the very reverse takes place; the production of true pus ceases, and the fluid becomes changed in some measure in proportion to these morbid alterations; in general it becomes thinner and more transparent, as if the part was returning back to the adhesive state, it partakes more of the nature of the blood, as

is the case in most other secretions under similar circumstances. This, in common language, is not called pus, but sanies.

Pus, arising from such state of sores, has more of the serum, and frequently of the coagulating lymph in it, and less of the combination that renders it coagulable with a solution of sal ammoniac. It has a greater proportion also of the extraneous parts of the blood that are soluble in water, such as salts; and becomes sooner putrid. The two last species of matter not being of the same specific nature with the sore, they have the power of stimulating even their own sore.

On this last account too, pus becomes more irritating to the adjoining parts, with which it comes in contact, producing excoriation of the skin, and the ulcerative inflammation; as the tears, when they run out, excoriate the skin of the cheek from the quantity of salts which they contain. From this effect the matter has been called corrosive, a quality which it has not; the only quality which it possesses being that of irritating the parts with which it comes in contact, in such a manner that they are removed out of the way by the absorbents, as will be described when treating on ulceration.

In these instances of the change in the pus,

we may say that the change is effected by the decomposition and new combination not being carried on so perfectly; this may probably depend on the secreting vessels having lost their due structure and action, and this appears to be so much the case, that they not only fail in this operation, but the other offices of those vessels, viz. the production of granulations, is also checked; for the vessels forming themselves into a certain structure which fits them for secreting pus, it is so ordered, that the same structure also fits them for producing granulations, and thus those two processes are concomitant effects of the same cause, which cause is a peculiar organization superadded to the vessels of the part.

What organization this may be is not in the least known, or must we wonder at this, for it is exactly the same with every other organ of secretion, about all which we are equally ignorant; indeed, some of the differences between one gland and another are made out, and also something of their general structure; but not in such a way as can lead us to the actions and operations of the several parts upon which the nature of the different secretions depend, so as to enable us to conclude *à priori*, that this or that gland must secrete this or that peculiar juice.



Pus, from several circumstances often attending it, would appear in general to have a greater tendency to putrefaction than the natural juices have; but I very much suspect that this is not really the case with pure pus; for when it is first discharged from an abscess, it is in general perfectly sweet. There are, however, some exceptions to this, but these depend on circumstances entirely foreign to the nature of pus itself. Thus, if the abscess had any communication with the air while the matter was confined in it, (as is frequently the case with those in the neighbourhood of the lungs) or if it has been so near the colon or rectum, as to have been infected by the fœces, under such circumstances we cannot wonder that it becomes putrid: matter formed early in the state of suppuration, either in abscesses, or more especially in consequence of any external violence committed on the solids, has always in it a portion of blood; or if some parts of the solids mortify and slough, these will mix with the matter; the same thing happens when the inflammation has something of the erysipelatous disposition, so as to have produced a mortification in the seat of the abscess; in all such circumstances we find the pus has a greater tendency to putrify than the pure or true pus, which comes to be discharged afterwards in sound abscesses

or healing sores; and accordingly the matter from recent sores becomes very putrid between every dressing; whereas, when the same sores are further advanced, it is perfectly sweet at the same periods; but although the imperfect or heterogeneous matter that is formed at first is liable to putrefy when exposed, yet if it is perfectly confined in an abscess, it will remain a considerable time without putrefaction; the suppuration, however, in consequence of the erysipelatous inflammation, which is often attended with suppuration produced by internal mortification, is, as we have observed, an exception to this rule; for although confined from external air, yet the matter becomes soon putrid, and this most probably arises from the solids themselves first becoming putrid.

A similar observation may be made with respect to sores which have been in the habit of discharging good pus; for if by any accident an extravasation of blood is produced in these parts, or a disposition is brought on to throw out blood, which mixes with the pus, the discharge changes from its former sweetness, and becomes much more putrid and offensive. It appears that pure matter, although easily rendered susceptible of change by extraneous

additions, is in its own nature pretty uniform and immutable. It appears so unchangeable, that we find it retained in an abscess for weeks, without having undergone any change; but these qualities belong only to perfect pus; for if a sore from a sound state changes its disposition and becomes inflamed, the matter now produced from it, though there be no extravasated blood or dead solids, becomes much sooner putrid than that which was discharged before this alteration of disposition, and shall become much more irritating, as has already been observed.

From the abovementioned considerations, we can explain why the discharge in many specific diseases, although not in all, is so much more offensive than in common sores; for in these cases it is commonly not true pus, and is generally mixed with blood.

In the same manner, likewise, where there are diseased bones, or other extraneous bodies which excite irritation, sometimes even to so great a degree as to cause the vessels to bleed, and often wounding the vessels of the part, the matter is always found to be very offensive, one mark (although not commonly accounted for) of a diseased bone.

Our silver probes are rendered almost black,

when introduced into the discharge of an unhealthy sore; preparation of lead are the same, when applied to such matter. It even dissolves animal substance; if, for instance, a fresh wound has its lips brought together and held there with sticking plaister spread upon leather, we shall find if the wound suppurates, that the parts of the straps of leather going over the wound will be between the first and second dressing quite dissolved, dividing the straps into their two ends; and the plaister, which commonly has lead in it, shall become black, where it has come in contact with this matter. This change in the colour of metals is also produced by eggs, when not perfectly fresh, although not become putrid; and probably this property is assisted by the boiling or roasting. Dr. Crawford, in his experiments on the matter of cancers and animal hepatic air, attributes the dissolution of the metals to that air.\*

### III. *Of the Use of Pus.*

The final intention of this secretion of matter is, I believe, not yet understood, although

\* Philos. Transact. vol. 80th, year 1790, part 2d, page 395.



almost every one thinks himself able to assign one; and various are the uses attributed to it. It is by some supposed to carry off humours from the constitution. It is sometimes supposed a constitutional disease changed into a local one, and so discharged or thrown out of the body, either in form of, or with the pus, as in those cases to be called critical abscesses; but even those who see this final intention are very ready to overturn it, by supposing that this matter is capable of being taken back again into the constitution by absorption, and producing much worse evils than those it was meant to relieve. I believe that the supposed cases of absorption are more numerous than those where it is supposed to relieve; if so, then by their own account nothing is gained. Or it is presumed to carry off local complaints from other parts of the body by way of derivation, or revulsion; for this reason sores, as issues, are made in sound parts, to allow other sores to be dried up; or even with a view to oblige parts to dissolve themselves into pus, as indurated swellings; but we have endeavoured to show that the solids make no part of pus.

A secretion of pus is also looked upon as a general prevention of many, or of all the causes of disease; issues, therefore, are made to keep

off both universal disease as well as local. But I am apt to believe that we are not yet well, or perhaps at all acquainted with its use, for it is common to all sores; takes place in the most perfect degree in those sores which may be said to be the most healthy, and especially in those where the constitution is most healthy.

We find also that very large discharges, when proceeding from a part which is not essential to life, produces very little change in the constitution, and as little upon being healed up, whatever some people may suppose to the contrary.

One might naturally imagine, that it was of service to the sore which formed it, to keep it moist, etc. for all internal surfaces have their peculiar moisture; but as a sore is to heal, and if allowed to dry so as to form a scab, then a sore is disposed to form no more pus, and heal faster. It is the mode of dressing external sores that keeps up this secretion, which in this respect maintains the sore in the state of an internal one; but this will not account for the formation of an abscess, which is the formation of pus we can best account for, since it produces the exposure of internal surfaces; in many cases it is of singular service, to procure the second mode of cure and open a communication

between the disease and the external surface of the body.

It also forms a passage for the exit of extraneous bodies; but all these are only secondary uses.

## CHAPTER VI.

*THE ULCERATIVE INFLAMMATION.*

**I**N considering the origin and course of the blood, it would have been most natural to have considered absorption, or the absorbing vessels; for in one point of view, they may be considered as the animal consisting of so many mouths, every thing else depending upon them, or belonging to them; for in tracing these dependences we find that there exists ultimately little else but absorbents. The stomach and the organs connected with it in such animals as have a stomach, are to be considered as subservient to this system; and many an animal is to be considered as consisting of a number of stomachs; a piece of coral, for instance, appears to be no more than a thousand stomachs, all taking in food for digestion, and absorption for increase, and support of the whole; for each stomach does not increase, as the piece of coral increases, but they multiply in number, and of course the whole piece of coral increases; for although each appears to be a distinct animal, yet it is not so; but as this is too general a view of this



system for our present purpose, I shall leave it, and confine myself principally to the uses of the absorbents in the diseases of which I am going to treat; and as one of their uses in diseases, and indeed the principal one, has not been described, nor indeed in the least conjectured, that it may be clearly understood or distinguished from the other known uses, I shall relate first the more common uses, which have been formerly assigned to this system.

First, the absorbents take up extraneous matter, in which is included nourishment.

Secondly, superfluous and extravasated matter, whether natural or diseased.

Thirdly, the fat.

Fourthly, they produce a waste of parts, in consequence of which muscles become smaller, bones become lighter, etc. Although these two last effects were perhaps not expressly said to be carried on by absorption, either by veins, or any other system of vessels, yet we must suppose they were understood: so far the absorbents have in general been considered as active parts in the animal œconomy; but from a further knowledge of these vessels, we shall find that they are of much more consequence in the body than has been imagined, and that they are often taking down what the arteries had formerly built up; removing whole organs, becoming modellers

of the form of the body while growing; also removing many diseased and dead parts, which were beyond the power of cure; of all which I shall now take particular notice.

As these vessels are productive of a vast variety of effects in the animal œconomy, which are very dissimilar in the intention and effect, they may be reviewed in a variety of lights, and admit of a variety of divisions. I shall consider them in two views: first, as they absorb matter, which is not any part of the machine; secondly, as they absorb the machine itself.

The first of these is the well-known use, the absorption of matter, which is no part of the machine. This is of two kinds, one exterior matter, in which may be ranked every thing applied to the skin, as also the chyle; and the other interior, such as many of the secreted juices, the fat, and the earth of bones, etc.<sup>a</sup> These are principally with a view to its nourishment, and also answer many other purposes; so that the action of absorbing foreign matter is extremely extensive; for besides its salutary effects, it is often the cause of a thousand

<sup>a</sup> It may be necessary to remark here, that I do not consider either the fat, or the earth of bones, as a part of the animal; they are not animal matter; they have no action within themselves. They have not the principle of life.

diseases, especially from poisons, none of which are to my present purpose.

In the second of these views, we are to consider them as removing parts of the body itself, in which they may be viewed in two lights. The first is, where only a wasting is produced in the whole machine, or part, such as in the wasting of the whole body, from an atrophy; or in a part, as in the wasting of the muscles of the leg, etc. from some injury done to some nerve, tendinous part, or joint; all of which I call interstitial absorption, because it is removing parts of the body out of the interstices of that part which remains, leaving the part still as a perfect whole.<sup>b</sup> But this mode is often carried further than simply wasting of the part; it is often continued till not a vestige is left, such as the total decay of a testicle, so that the interstitial absorption might be understood in two senses.

The second is, where they are removing whole parts of the body. This may be divided into the natural, and the diseased.<sup>c</sup>

In the natural they are to be considered as

<sup>b</sup> This mode of absorption has always been allowed, or supposed, whether performed by the lymphatic veins, or lymphatics.

<sup>c</sup> These uses I claim as my own discovery. I have taught them publicly ever since the year 1772.

the modellers of the original construction of the body; and if we were to consider them fully in this view, we should find that no alteration can take place in the original formation of many of the parts, either in the natural growth, or that formation arising from disease, in which the absorbents are not in action, and take not a considerable part: this absorption I shall call modelling absorption. If I were to consider their powers in this light, it would lead me into a vast variety of effects, as extensive as any principle in the animal œconomy, for a bone cannot be formed without it, nor probably many other parts. A part which was of use in one stage of life, but which becomes entirely useless in another, is thus removed. This is evident in many animals; the thymus gland is removed; the ductus arteriosus, and the membrana pupilaris is removed. This process is, perhaps, more remarkable in the changes of the insect, than in any other known animal. Absorption in consequence of disease, is the power of removing complete parts of the body, and is in its operation somewhat similar to the first of this division, or modelling process, but very different in the intention, and therefore in its ultimate effects.

This process of removing whole parts in consequence of disease, in some cases produces



effects which are not similar to one another; one of these is a sore or ulcer, and I therefore call it ulcerative. In other cases no ulcer is produced, although whole parts are removed, and for this I have not been able to find a term; but both may be denominated progressive absorption.

This process of the removal of a whole solid part of the body; or that power which the animal œconomy has of taking part of itself into the circulation by means of the absorbing vessels, whenever it is necessary, is a fact that has not in the least been attended to, nor was it even supposed, and having now been noticed, I mean to give a general idea of it. I may just be allowed once more to observe, that the oil, or fat, of animals, and the earth of bones, have always been considered as subject to absorption; and some other parts of the body being liable to wasting, have been supposed to suffer this by absorption; but that any solid part should totally be absorbed, is a new doctrine.

This use of the absorbents I have long been able to demonstrate; and the first hints I received of it, were in the waste of the sockets of the teeth, as also in the fangs of the shedding teeth.

It may be difficult at first to conceive how a part of the body can be removed by itself;

but it is just as difficult to conceive how a body can form itself, which we see daily taking place; they are both equally facts, and the knowledge of their mode of action, would answer perhaps very little purpose; but this I may assert, that whenever any solid part of our bodies undergoes a diminution, or is broken in upon, in consequence of any disease, it is the absorbing system which does it.

When it becomes necessary that some whole living part should be removed, it is evident that nature, in order to effect this, must not only confer a new activity on the absorbents, but must throw the part to be absorbed into such a state as to yield to this operation.

This is the only animal power capable of producing such effects, and like all other operations of the machine arises from a stimulus, or an irritation; all other methods of destruction being either mechanical or chemical. The first by cutting instruments, as knives, saws, etc. the second by caustics, metallic salts, etc.

The process of ulceration is of the same general nature in all cases; but some of the causes and effects are very different from one another.

The knowledge of the use of this system is but of late date; and the knowledge of its different modes of action is still later. Physiolo-

gists have laboured to account for its modes of action; and the principle of capillary tubes was at first the most general idea, because it was a familiar one. But this is too confined a principle of an animal machine, nor will it account for every kind of absorption. Capillary tubes can only attract fluids; but as these inquirers found that solids were often absorbed, such as scirrhus tumors, coagulated blood, the earth of bones, etc. they were driven to the necessity of supposing a solvent; this may or may not be true; it is one of those hypotheses that can never be proved or disproved, and may for ever rest upon opinion. But my conception of this matter is, that nature leaves as little as possible to chance, and that the whole operation of absorption is performed by an action in the mouths of the absorbents: but even under the idea of capillary tubes, physiologists were still obliged to have recourse to the action of those vessels to carry it along after it was absorbed; and might therefore as well have carried this action to the mouths of these vessels.

As we know nothing of the mode of action of the mouths of these vessels, it is impossible we can form any opinion that can be relied upon; but as they are capable of absorbing substances in two different states, that of solidity and fluidity, it is reasonable to suppose that they

have different modes of action; for although any construction of parts that is capable of absorbing a solid, may also be such as is capable of absorbing a fluid; yet I can suppose a construction only capable of absorbing a fluid, and not at all fitted for absorbing a solid, though this is not likely; and to see the propriety of this remark more forcibly, let us only consider the mouths of different animals, and I will venture to say, that the mouths of all the different animals have not a greater variety of substances to work upon, than the absorbents have, and we may observe that with all the variety of mouths in different animals, this variety is only for the purpose of adapting them to absorb solids, which admit of great variety in form, texture, etc. every one being capable of absorbing fluid matter, which admits of no variety.

This process of the removal of parts of the body, either by interstitial or progressive absorption, answers very material purposes in the machine, without which many local diseases could not be removed, and which, if allowed to remain, would destroy the person. It may be called in such cases, the natural surgeon.

It is by the progressive absorption, that matter or pus, and extraneous bodies of all kinds, whether in consequence of or producing in-



flammation and suppuration are brought to the external surface; it is by means of this that bones exfoliate; it is this operation which separates sloughs; it is the absorbents which are removing whole bones, while the arteries are supplying new ones; and although in these last cases of bones, it arises from disease, yet it is somewhat similar to the modelling process of this system in the natural formation of bone; it is this operation that removes useless parts, as the alveolar processes, when the teeth drop out, or when they are removed by art; as also the fangs of the shedding teeth, which allows them to drop off; and it is by these means ulcers are formed.

It becomes a substitute in many cases for mortification, which is another mode of the loss of substance; and in such cases it seems to owe its taking place of mortification to a degree of strength or vigor, superior to that where mortification takes place; for although it arises often from weakness, yet it is an action, while mortification is the loss of all action. In many cases it finishes what mortification had begun, by separating the mortified part.

These two modes of absorption, the interstitial and the progressive, are often wisely united, or perform their purposes often in the

same part which is to be removed; and this may be called the mixed, which I believe takes place in most cases, as in that of extraneous bodies of all kinds coming to the skin; also in abscesses, when in soft parts. It is the second kind of interstitial absorption, the progressive and the mixed, that become mostly the object of surgery, although the first of the interstitial sometimes takes place, so as to be worthy of attention.

This operation of the absorption of whole parts, like many other processes in the animal economy, arising from disease, would often appear to be doing mischief, by destroying parts which are of service, and where no visible good appears to arise from it; for it is this process which forms a sore called an ulcer; such as in those cases where the solids are destroyed upon the external surface, as in old sores in the leg, breaking out anew, or increasing; but in all cases it must still be referred to some necessary purpose; for we may depend upon it, that those parts have not the power of maintaining their ground, and it becomes a substitute for mortification; and indeed in many ulcers, we shall see both ulceration and mortification going on, ulceration removing those parts that have power to resist death.

I. *Of the Remote Cause of the Absorption of the Animal itself.*

THE remote cause of the removal of parts of the animal appears to be of various kinds, and whatever will produce the following effects, will be a cause.

The most simple intention, or object of nature, seems to be the removal of a useless part, as the thymus gland, membrana pupilaris, ductus arteriosus, the alveoli when the teeth drop, or the crystalline humour after coughing, and probably the wasting of the body from fever, either acute or hectic. These parts are removed by the absorbents, either as useless parts, or in consequence of strength being unnecessary while under disease, or such as not to accord with disease.<sup>d</sup>

Another cause is a weakness, or the want of power in the part to support itself under certain irritations, which may be considered as the basis of every cause of removal of whole parts; as the

<sup>d</sup> It might be asked as a question, whether the waste of the constitution in disease arises from the body becoming useless when under such diseases, as may be observed of muscles when their joint, tendon, etc. is diseased; or whether it accords better with the diseased state, and may even tend to a natural cure?

absorption of calluses, cicatrices, the gums in salivation; also that arising from pressure, or irritating applications, under which may be included the attachment of dead parts to a living one; all of which may be accounted for upon the same principle of parts or organs not being able to support themselves under the present evil.

From the above account of the final cause of the absorption of whole parts from disease, it would appear that they are capable of being absorbed from five causes. First, from parts being pressed; secondly, from parts being considerably irritated by irritating substances; thirdly, from parts being weakened; fourthly, from parts being rendered useless; fifthly, from parts becoming dead. The two first, for instance, parts being pressed, and parts being irritated, appear to me to produce the same irritation; the third, or weakness, an irritation of its own kind; and the fourth, or parts being rendered useless, and the fifth, or parts becoming dead, may be somewhat similar.

It is probable that every cause above enumerated is capable of producing every mode, or rather effect of absorption, whether interstitial or progressive; but pressure attended with suppuration always produces the progressive, whether applied externally or internally, as in the case of abscesses.



## II. *Of the Disposition of Living Parts to absorb and to be absorbed.*

THE dispositions of the two parts of the living body, which absorb and are absorbed, must be of two kinds respecting the parts; one passive and the other active. The first of these is an irritated state of the part to be absorbed, which renders it unfit to remain under such circumstances; the action excited by this irritation being incompatible with the natural actions and the existence of the parts, whatever these are, therefore become ready for removal, or yield to it with ease. The second is the absorbents being stimulated to action by such a state of parts, so that both conspire to the same end.

When the part to be absorbed is a dead part, as nourishment or extraneous matter of all kinds, then the whole disposition is in the absorbents.

When those immediate causes arise in consequence of pressure, it would appear that absorption takes place more readily under certain circumstances than others, although the remote causes of them appear to be the same, therefore something more than simple pressure; for we find that pressure from within produces

ulceration or absorption much more readily than from without; for if it was pressure only, absorption then would be according to the quantity of pressure; but we find very different effects from the same quantity of pressure under the abovementioned circumstances; for when from without, pressure rather stimulates than irritates; it shall give signs of strength, and produce an increase of thickening; but when from within, the same quantity of pressure will produce waste; for the first effect of the pressure from without is the disposition to thicken, which is rather an operation of strength; but if it exceeds the stimulus of thickening, then the pressure becomes an irritator, and the power appears to give way to it, and absorption of the parts pressed takes place, so that nature very readily takes on those steps which are to get rid of an extraneous body, but appears not only not ready to let extraneous bodies enter the body, but endeavours to exclude them, by increasing the thickness of the parts.

Many parts of our solids are more susceptible of being absorbed, especially by ulceration, than others, even under the same or similar circumstances, while the same part shall vary its susceptibility according to circumstances.

The cellular and adipose membranes are very particularly susceptible of being absorbed,

which is proved by muscles, tendons, ligaments, nerves and blood vessels being found frequently deprived of their connecting membrane and fat, especially in abscesses, so that ulceration often takes a roundabout course to get to the skin, following the track of the cellular membrane; and the skin itself, when the pressure is from within, is much less susceptible of ulceration than the cellular and adipose membrane, which retards the progress of abscesses, when they are so far advanced, and also becomes the cause of the skin's hanging over spreading ulcers, which are spreading from the same cause; more especially, too, if the part ulcerating is an original part. Ulceration never takes place on investing membranes of circumscribed cavities, excepting suppuration has taken place; and, indeed, ulceration in such parts would be a sure forerunner of suppuration.

New formed parts, or such as cannot be said to constitute part of the original animal, as healed sores, calluses of bones, especially those in consequence of compound fractures, admit more readily of absorption, especially the progressive, than those parts which were originally formed; this arises probably from the principle of weakness, and it is from this too, that all adventitious new matter, as tumors, are more readily absorbed than even that which is a sub-

stitute for the old. Thus we have tumors more readily absorbed than a callus of a bone, union of a tendon, etc. because they have still less powers than those which are substitutes for parts originally formed.

Ulceration in consequence of death in an external part, takes place soonest on the external edge between the dead and the living. This is visible in the sloughing of parts; for we may observe that sloughs from caustics, bruises, mortifications, etc. always begin at the external edge.

An internal pressure produced by an extraneous body, acts equally on every side of the surrounding parts, and therefore every part being pressed alike, ought, from this cause alone, to produce absorption of the surrounding parts equally on all sides, supposing the parts themselves similar in structure, or, which is the same, equally susceptible of being absorbed; but we find that one side only of the surrounding living parts is susceptible of this irritation, therefore one side only is absorbed; and this is always the side which is next to the external surface of the body. We, therefore, have always extraneous bodies of every kind, determined to the skin, and on that side to which the extraneous body is nearest, without having any



effect, or producing the least destruction of any of the other surrounding parts. From this cause we find abscesses, etc. whose seat is in, or near the centre of a part, readily determined to the surface on the one side, and not on the other; and whenever the lead is once taken, it immediately goes on. But as some parts, from their structure, are more susceptible of this irritation than others, we find that those parts composed of such structure, are often absorbed, although they are not in the shortest road to the skin; this structure is the cellular membrane, as will be taken notice of hereafter.

We find the same principle in the progress of tumors; for although every part surrounding a tumor is equally prest, yet the interstitial absorption only takes place on that side next the external surface, by which means the tumor is, as it were, led to the skin; from hence we find that absorption of whole parts more readily takes place, to allow an extraneous substance to pass out of the body, than it will to allow one to pass in.

Thus we see, that the slight pressure produced by matter on the inside of an abscess has a great effect, and the matter is brought much faster to the skin (although very deep) than it would by the same quantity of pressure applied

from without; and, indeed, so slight a pressure from without would rather tend to have an opposite effect, namely that of thickening.

The reason of this is evident; one is, a readiness in the parts to be freed from a disease already existing; the other is, a backwardness in the parts to admit a disease. This principle, therefore, in the animal œconomy produces one of the most curious phenomena in the whole process of ulceration, viz. the susceptibility which the parts lying between an extraneous body and the skin have to ulcerate, while all the other sides of the abscess are not irritated to ulceration; and the necessity there is that it should be so, must be very striking; for if ulceration went on equally on all sides of an abscess, it must increase to a most enormous size, and too great a quantity of our solids must necessarily be destroyed.

Bones, we have observed, are also subject to similar circumstances of ulceration; for whenever an abscess forms in the centre of a bone, or an internal exfoliation has taken place, the extraneous body acts upon the internal surface of the cavity, and produces ulceration.

If the matter or dead piece of bone is nearer one side than the other, ulceration takes place on that side only; and here too the provision of nature in abscesses come in, for the adhesive

inflammation extends itself on the outside in proportion as ulceration extends itself on the inside of the cavity, and as ulceration approaches to the surface of the bone, the adhesive disposition is given to the periosteum, then to the cellular membrane, etc. And what is very curious, this adhesive inflammation assumes the ossifying disposition, which I have called the ossific inflammation, and appears as a spreading ossification, in the same manner as in the callus of a simple fracture.

The consequence of these two processes taking place together in bones is very singular, for the ulcerative process destroying the inside of a bone while the ossifying makes addition to its outside, the bone often increases to a prodigious size, as in cases of *spinæ ventosæ*; but in the end the ulceration on the inside gets the better, and the matter makes its escape.

Nature has not only made what might be called an instinctive provision in the parts to remove themselves, so as to bring extraneous bodies to the skin for their exit, and thereby, from this principle, has guarded the deeper seated parts; but has also guarded all passages or outlets, where, from reasoning, we might suppose no great mischief could arise from bringing extraneous bodies thither; and in many cases a seeming advantage would be gained; such pas-

sages appearing to be more convenient for the exit of such matter, and likely to produce less visible mischief in procuring them.

Thus a tumour in the cheek, close on the internal membrane of the mouth, and some way from the skin, shall in its growth push externally, especially if there is matter in it, and in time come in contact with the skin and adhere to it, while it shall have made no closer connexion with the skin of the mouth: if it should suppurate, and more especially if it be of a scrofulous kind, which is slow in its progress, it will break externally; we even see abscesses in the gums opening externally, where the matter has been obliged to go a considerable way to get to the skin.

The same guard is set over the cavity of the nose; if an abscess forms in the antrum, frontal sinus, or saccus lacrimonalis, all of which are nearer to the cavity of the nose than the external surface of the body, ulceration does not follow this shortest way, which would be directly into the nose, but leads the matter to the nearest external surface.

I have seen an abscess in the frontal sinus, first attended with great pain in the part, then with inflammation on the whole forehead, at last matter has been felt under the skin; and on being opened it has led into one or both sinuses,



and almost the whole bone has exfoliated. For such an abscess, the nearest passage would have been directly into the nose. Abscess in the lacrimal sac, forming what is called the fistula lacrimalis, arises also from the same cause; a curious circumstance takes place here; but whether peculiar to this part or not, I do not yet know. Besides the disposition for ulceration externally at the inner corner of the eye, there is a defence set up upon the inside, so that the membrane of the nose thickens very considerably; how far a thickening takes place on the inside of the nose opposite to the antrum, in abscesses of that cavity, or how far it is an universal principle in other passages, I have not been able to learn, but am inclined to believe it is not universal. From this principle we can see why openings made into these passages to make the matter come that way are more unsuccessful, than reasoning (without the knowledge of this principle) would lead us to believe; the opening, therefore, should not be made on the inside (even where we can do it) excepting the matter is very near, or else the opening should be made very large; and probably, in such cases, it may be necessary to take out a piece, so as to prevent the uniting process, which is here very strong.

Illustrations will be given in other passages,

when treating of ulceration in general tending to the external surface.

### III. *Of Interstitial Absorption.*

INTERSTITIAL absorption, I observed, was of two kinds, with respect to effect, or rather had two stages. The first was, where it took place only in a part, as in the wasting of a limb in consequence of its being rendered useless, whether from disease in a joint, a broken tendon, or the dividing of a nerve, whereby its influence is cut off; or where it takes place in the whole body, in consequence of some disease, as in acute fever, hectic fever, diabetes, atrophy, or the like. The second is the absorption of a whole part, where not a vestige is left. This would seem to be of two kinds; one, where it is only a consequence of another disease, and is a necessary and useful effect of that disease, as in assisting in bringing parts to the surface; but the other appears to arise from a disease in the part itself; as the total decay of the alveoli, without any disease in the teeth or gums, which in the end suffer; as also a total wasting of a testicle, the absorption of a callus, etc. It is the first of these two kinds which is most to my present purpose, and deserves our particular attention.

It takes place in a thousand instances; we find it gradually taking place in the part of the body which happens to lie between incysted tumours, and the external surface, when they are making their way to the skin. This absorption is commonly slow in its progress, so much so, as even to make the ultimate effect, although considerable, not sensible till a certain length of time has elapsed.

This mode of removing parts, appears to arise from pressure, as in the former; but here some principles are reversed. The contents of an incysted tumour do not give the stimulus of removal to that side of the syst nearest to the external surface, as happens in an abscess, so as to produce a removal of the surface pressed by its contents, which would be the progressive ulceration, as in our first division; but the tumor gives the stimulus to the sound parts, between it and the skin, and an absorption of those parts takes place, similar to that which I suppose takes place in the removal of calluses of bones, from weakness. We find whenever an incysted tumour is formed in the cellular membrane, it in time makes its approaches towards the skin, by the cellular membrane and other parts between it and the skin being absorbed, so that the whole substance between the cyst and skin becomes thinner and thinner, till

the cyst and the external skin meet or come in contact, and then inflammation begins to take place; for as the parts are now soon to be exposed, inflammation takes place to produce a quicker absorption, which borders often upon ulceration. The mode of action in this last case may be, in one respect, very similar to the foregoing solid tumour, for besides the interstitial absorption, the cyst may be looked upon as a tumour, acting upon, or stimulating the parts between it and the skin; therefore the tumor causes absorption of the contiguous cellular membrane, upon which it presses. This process of interstitial absorption of parts is very evident, even in common abscess; where a progressive absorption is going on, it is assisted by this.

I have already observed, that the interstitial absorption is not attended with, nor produces suppuration.

#### IV. *Of the Progressive Absorption.*

THE first or principal mode of this action, is the removing of those surfaces that are immediately contiguous to the irritating causes which is an absorption of necessity. These causes, I have observed, are of three kinds; one,



pressure; another, irritating substances; and the third, considerable inflammation on a weak part, especially those new-formed parts that become a substitute for the old. Absorption, from pressure, is the removal of the part pressed, which may arise from a number of causes. There are tumours, which, by pressing upon neighbouring parts, produce it; the pressure of the blood in aneurisms produces it, etc. also that surface of an abscess which is in contact with the pus, or any other extraneous body; or the ulceration of that part of the surface of the body, which is in contact with a body pressing, as the buttocks or hips of those who lie long upon their backs. The heels of many people, who also lie long in the same position, as in the case with those who are under the cure of a fracture of the leg; in which case it seems to be a substitute for mortification, and is rather a proof of the strength of the patient; for if very weak constitutionally, the same parts certainly mortify; as also the constant pressure of chains on the legs of prisoners; harness on the breasts of horses.

The second of this cause of absorption is the action of irritating substances, such as the tears passing constantly over the cheeks; as also many irritating medicines, producing too much action, and probably at the same time weakening the parts. The third is, the formation of an

ulcer, or sore, on a surface, in consequence of some disease, which has been the cause of inflammation. Bones are subject to the same effect from pressure, as the soft parts; as in consequence of aneurisms; as also from the pressure from tumours; likewise in cases of the spina ventosa, where in some there is nothing to be found in the cavity of the swelling, but blood coagulated; in others, a grumous or curdly substance. This blood, or substance, increasing, continues the pressure, and the inside of the bone is in time absorbed.

I have already observed, that the progressive absorption is divisible into two kinds; one without suppuration, the other with. I shall now observe, that the absorption which does not produce suppuration, may take place, either from pressure made by sound parts, upon diseased parts, or by diseased upon sound parts; as the effect that the pressure of the coagulated blood has in aneurisms, the moving blood in the same, which is a sound part, contained in diseased arteries not capable of supporting the pressure of the moving blood; as also many tumours, which are diseased parts, pressing upon natural sound parts, and these diseased parts are simply endowed with life, which I apprehend makes some difference in the effects respecting the formation of pus; also uncommon pressure

made by such substances as are not endowed with any irritating quality, sufficient to produce the suppurative inflammation, as a piece of glass, a lead bullet, etc. all of which I shall now more fully explain.

Of this first division, viz. from pressure without suppuration, we have several instances; in aneurisms, especially when they are in the aorto, and principally at the curve; and when arrived at a considerable size, so as to press against the surrounding parts, particularly against the back-bone, as also against the sternum; all of which will be according to the situation of the aneurism: we find in such cases, that from the dilatation of the artery (which arises from the force of the heart) the artery is pressed against those bones, and that the substance of the artery in the part pressed is taken into the constitution. This absorption begins at the external surface of the artery, where it comes in contact with the bone, and continues there till the whole artery is absorbed; then the bone itself comes in contact with the circulating blood, and not being naturally intended to be washed by moving blood, the bone or bones are also absorbed from this pressure, and motion of the blood against them. The adhesive or strengthening disposition takes place in the surrounding parts, and is of great service here.

as it unites the circumference of the unabsorbed part of the artery to the surrounding parts; as also the cellular membrane beyond the surface of absorption, (when in soft parts) similar to the preceding adhesive inflammation going before ulceration in an abscess; but it is here much stronger, for strength is wanted as well as adhesion while it is dilating; so that a cavity of some strength for the moving blood is always kept entire, and no extravasation can take place, nor can the parts readily give way.

Another instance of this absorption occurs in those cases where living tumours make their way to the skin without the formation of an abscess. I once saw a remarkable instance of this in a Highland soldier, in the Dutch service, who had a solid tumour formed, either in the substance of the brain, or, what is more probable, upon it, viz. in the pia mater, for it seemed to be covered by that membrane: the tumour was oblong, above an inch thick, and two or more inches long; it was sunk near its whole length into the brain, seemingly by the simple effects of pressure; but the outer end of it, by pressing against the dura mater, had produced the absorbing disposition in that membrane, so that this membrane was entirely gone at that part.

The same irritation from pressure had been given to the scull, which also was absorbed at



this part; after which, the same disposition was continued on to the scalp.

As these respective parts gave way, the tumour was pushed further and further out, so that its outer end came to be in this new passage the absorbents were making for it in the scalp, by which it probably would have been discharged in time, if the man had lived; but it was so connected with the vital parts, that the man died before the parts could relieve themselves; while all these exterior parts were in a state of absorption, the internal parts which pressed upon the inner end of the tumour, and which pressure was sufficient to push it out, did not in the least ulcerate; nor did the tumour itself, which was pressed upon all sides, in the least give way in its substance. No matter was to be observed here from either the dura mater, the unconnected edge of the bones of the skull, nor from that part of the scalp which had given way; and, perhaps, the reason was, the tumour being a living part, and not an extraneous one. The general effect was, however, similar to the progress of an abscess, insomuch that it was on that side nearest to the external surface of the body that the irritation for absorption took place.

This first species of the absorption of whole parts is seldom or never attended with pain.

Its progress is so very slow, as to keep pace with our sensations, and in many cases it is not even attended with inflammation.

I believe that this absorption seldom or ever effects the constitution, although, in some cases it takes its rise from affections of the constitution, as in the cases of the absorption of callus.

V. *Of Absorption attended with Suppuration, which I have called Ulceration.*

I SHALL now give an account of that part of the actions of the absorbing system, which I call ulceration, and which is the second of our first division, respecting the formation of pus, viz. that which is connected with the formation of that fluid, being either a consequence of it, or producing it, and is that which in all cases constitutes an ulcer. It is this which principally constitutes the progressive absorption.\*

\* I have given it the term ulceration, because ulcer is a word in use to express a sore, and it is by this process that many ulcers are formed. The operations produced in ulceration, have not hitherto been in the least understood, therefore a very erroneous cause of these operations has been always supposed. It has always been supposed that those solids which

This differs from the foregoing in some circumstances of its operations. It either takes place in consequence of suppuration already begun, and then the pus acts as an extraneous body capable of producing pressure; or absorption attacks external surfaces from particular irritations or weakness, in which case suppuration, forming an ulcer, must follow, let the cause of that breach or loss of substance be what it may.

In order to produce ulceration from pressure, I may again take notice, that it requires a much greater pressure from without than from within; and when it is from within, the ulceration is quicker, when near to the skin, than when deep or far from it; the nearer to the skin, the inflammation more readily takes place; and I have also observed, that inflammation, although it takes place in deep seated parts, yet it seldom or never extends deeper, but approaches towards the external surface; and as inflammation seems to proceed and is essential to this process, we see the reason why it should take place sooner if near to the skin, and go on faster the nearer it comes to it.

were visibly gone, were dissolved into pus: from whence arose the idea of matter being composed of solids and fluids, which we have endeavoured to refute.

The process of ulceration which brings matter to the external surface is not wholly the absorption of the inner surface of the abscess, for there is an interior or interstitial absorption of the parts lying between the inner surface of the abscess and the skin, similar to the approach of incysted tumours, as has been described. And besides this assistance, I have already observed, there is a relaxing and elongating process carried on between the abscess and the skin; and at those parts only where the matter appears to point.

This process of ulceration, or absorption, with suppuration, is almost constantly attended by inflammation; but it cannot be called an original inflammation, but a consequent, which gave rise to the term ulcerative inflammation. It is always preceded by the adhesive inflammation, and perhaps it is simply this inflammation which attends it; we find the adhesions produced answering very wise purposes; for although the adhesive inflammation has preceded the suppurative, and of course all the parts surrounding the abscess are united, yet, if this union of the parts has not extended to the skin, where the abscess or matter is to be discharged, in such a case, wherever the ulceration has proceeded beyond the adhesions, there the matter will come into unadhering parts; the



consequence of which will be, that the fluid, or matter, will diffuse itself into the cellular membrane of the part, and from thence over the whole body, as in the erysipelatous suppuration; but to prevent this effect, the adhesive inflammation takes the lead of ulceration. There are many other causes of ulceration, which take place on surfaces, where we do not see the same necessity for it, when the matter formed can be, and is discharged without it; such parts are many old sores. The inside of the stomach and intestines, and indeed all the surfaces above-mentioned, which do not admit readily of the adhesive inflammation, under some circumstances admit of the ulcerative. This effect would appear to arise from the violence of the inflammation, the parts being so weakened, either by it, or some former disease, that they can hardly support themselves; for we find in salivations, where the whole force of the mercury has been determined to the mouth, they have become weakened by long and violent action; the gums and inside of the mouth will ulcerate; also, from the same weakening disposition, the gums will ulcerate in bad scurvies; therefore weakness joined with inflammation, or violence of action, appears to be the immediate cause in such cases.

The effect then of irritation, as above de-

scribed, is to produce first the adhesive inflammation in such parts as will readily admit of it, and if that has not the intended effect, the suppurative takes place, and then the ulceration comes on to lead the matter already formed to the skin, if it is confined.

The natural consequence of suppuration in such parts, is the growth of new flesh, called granulations, which are to repair the loss the parts sustained by the injury done; but in all outlets, where the adhesive would be hurtful, the irritation first only produces the suppurative inflammation; but if carried further, the adhesive will take place, as has been described; and, as in such parts the matter formed has an outlet, ulceration is also avoided; and, as in such cases no parts are destroyed, granulations are also excluded.

There appears to be a curious circumstance attending ulceration, which is the readiness with which it seems to absorb every other substance applied to it, as well as the body itself; at least this appears to be the case with the small-pox after inoculation; as also the venereal chancre; whether arising from the absorbents at the time being in the act of absorbing, or whether they promiscuously absorb what is applied, along with the part themselves. In such cases it might be a question also, whether the parts of the body

which they do absorb have the same disposition with the pus of that part, as in the cancer, therefore contaminate the constitution, as in the small-pox and venereal disease, as readily as if it was the pus.

From what has been observed, it must appear that any irritation which is so great as to destroy suddenly the natural operations of any one part, and the effect of which is so long continued as to oblige the parts to act for their own relief, produces in some parts, first the adhesive inflammation; and if the cause be increased, or continue still longer, the suppurative state takes place, and all the other consequences, as ulceration; or, if in the other parts, as secreting surfaces, then the suppurative takes place immediately; and if too violent, the adhesive will succeed; or if parts are very much weakened, the ulcerative will immediately succeed the adhesive, and then suppuration will be the consequence.

This species of ulceration in general gives considerable pain, which pain is commonly distinguished by the name of soreness; this is the sensation arising from cutting with an instrument, which operation is very similar to ulceration; but this pain does not attend all ulcerations, for there are some of a specific kind, which give little or no pain, such as the scrofula;

but even in this disease, when the ulceration proceeds pretty fast, it gives often considerable pain; therefore the pain may be in some degree proportioned to the quickness of its operation.

The greatest pain which in general attends this operation arises from those ulcerations which are formed for the purpose of bringing the matter of an abscess to the skin; as also where ulceration begins upon a surface, or is increasing a sore. Whether the increase of pain arises from the ulcerative inflammation singly, or from the adhesive and ulcerative going on together in the same point, is not easily determined; but in some cases these three are pretty rapid in their progress, and it is more than probable that the pain arises from all these causes.

In those cases where ulceration is employed in separating a dead part, such as sloughing, exfoliation, etc. it is seldom attended with pain; perhaps it may not be easy to assign a cause for this.

The effects that ulceration has upon the constitution I have mentioned, with the effects that other local complaints have upon it.

It is easy to distinguish between a sore that is ulcerating, and one which is standing still, or granulating.

The ulcerating sore is made up of little ca-



vities or hollows, and the edge of the skin is scalloped or notched; is thin, turned a little out, and overhangs, more or less, the sore. The sore is always foul, being probably composed of parts not completely absorbed; and discharges a thin matter.

But when the ulceration stops, the edge of the skin becomes regular, smooth, a little rounded or turned in, and of a purple colour, covered with a semi-transparent white.

## VI. *Of the relaxing Process.*

BESIDES these two modes of removing whole parts, acting singly or together, there is an operation totally distinct from either, and this is a relaxing and elongating process, carried on between the abscess and the skin, and at those parts only where the matter appears to point. It is possible that this relaxing, elongating, or weakening process may arise in some degree from the absorption of the interior parts; but there is certainly something more, for the skin that covers an abscess is always looser than a part that gives way from mere mechanical distention, excepting the increase of the abscess is very rapid.

That parts relax, or elongate, without me-

chanical force, but from particular stimuli, is evident in the female parts of generation, just before the birth of the fœtus ; they become relaxed prior to any pressure. The old women in the country can tell when a hen is going to lay, from the parts becoming loose about the anus.

That this relaxing process takes place between an abscess and the skin is evident in all cases, but was more demonstratively so in the following case than commonly can be observed where an increase of surface takes place without the visible loss of substance, for here both could be exactly ascertained ; and, indeed, no abscess could swell outwards, excepting by distention, without it.

In the following case this process was particularly evident.

A lad, about thirteen years of age, was attacked with a violent inflammation in his belly, without any apparent cause. The usual means were used, but without effect. His belly began to swell in a few days after the attack, and his skin became cold and clammy, especially his feet and hands. Once, when he made water, it was transparent like spring water, with a little cloud of mucus. In several places of the belly, there appeared a pointing, as if from matter ; one of those, which was just below the sternum,

became pretty large, and discoloured with a red tint. Although there was not any undulation or perfect fluctuation (there not being fluid enough for such a feel) yet it was plain there was a fluid, and most probably, from the pointings, it was matter in consequence of inflammation, and that it was producing ulceration on the inside of the abdomen for its exit; therefore it was thought advisable, as early as possible, to open the belly at one of those parts. I made a small opening into the pointing part, just below the sternum, hardly an inch long: when I was performing the operation, I saw plainly the head of the rectus muscle, which I cut through in the direction of its fibres. There was immediately discharged by this wound about two or three quarts of a thin bloody matter. The swelling of the abdomen subsided of course; his pulse began to rise and become more full and soft, and his extremities became warmer; he was ordered bark, etc. but he lived only about sixty hours after the operation.

On opening his abdomen after death we found little or no matter lying loose; all had made its escape through the wound. The whole intestines, stomach, and liver, were united by a very thick covering of the coagulating lymph, which also passed into all the interstices between them, by which means they

were all united into one mass: the liver also adhered to the diaphragm, but none of the viscera adhered to the inside of the belly on its fore part, for there the matter had given the stimulus for ulceration, which prevents all adhesions. The process of ulceration had gone on so far as to have destroyed the whole of the peritoneum on the fore part of the abdomen, and the transversales, and recti muscles, were cleanly dissected on their inside.

The tendons of the lateral muscles, that pass behind the heads of the recti, were in rags, partly gone, and partly in the form of a slough.

From this view of the case, we must see how nature had guarded all the most essential parts. In the time of the adhesive stage, she had covered all the intestines with a coat of coagulating lymph, so as to guard them; and this, probably, upon two principles, one, from their being canals, and therefore loath to admit of penetration in that way; the other, from their being more internal than the parietes of the abdomen: one side is therefore thickened for their defence, while the other is thinned for the relief of the part.

Here the cavity of the abdomen had assumed all the properties of an abscess, but it was so connected with the vital parts, which also suffered much in the inflammation, that the patient



could not support the necessary processes towards what would be called a radical cure in many other parts; and indeed, considering the mischief done to the abdomen and its viscera, it is astonishing he lived so long.

The most curious circumstance that happened, was the appearance of pointing in several places; for why one part of the abdomen should have pointed more than another is not easily accounted for, since every part of the anterior portion was nearly equally thin, each part was equally involved in the abscess, and the ulceration had not yet begun with any of the muscles. To account for this, let us suppose that one, two, or three parts (by some accident) were more susceptible of the ulcerative stimulus than the others, and that the parts were ready to give way; but although these parts which were pointing, were the places where ulceration would have gone on brisker, yet it had not proceeded further here than in any other part; it had only gone through the peritoneum, and the tendons of the broad muscles; and the recti muscles were sound and perfect at the place where I made the opening, which was the most protuberant of any; therefore this pointing did not appear to arise from weakness or thinness of this part; and, even supposing that the pointing was an effect of

weakness, it would imply a great deal of pressure on the inside, (which at least was not the case here) and simple pressure, although a hundred times greater, which we often see take place in dropsies, would not produce a pointing, if not attended with some specific power.

If pressure then was not sufficient to produce this effect in the present case, and if the parts which pointed were as mechanically firm as at any other, to what other cause can we attribute the distention of this part, but to the weakening, elongating, and relaxing process, which I have already described?

This observation of the relaxing process going on in the substance of the parts where it points, is verified in a thousand instances: suppose a large abscess in the thigh, only covered by the skin and adipose membrane, which shall go on for months without producing ulceration, and of course not point any where, but shall be a smooth, even, and uniform surface, let it receive the stimulus of ulceration in any one part, that part will immediately begin to point, although it may be thicker there than at some other parts of the same abscess.

The pressure necessary to allow extraneous matter to make its escape, need not be great; for in many abscesses which have been opened, or have opened of themselves, but not at the

most depending part, so that the matter is allowed to stagnate at the lower part of the cavity, making a very slight pressure, we find that this alone is sufficient to produce ulceration in that part, and of course a fresh opening is produced, more especially if near the skin; this we see often take place in abscesses of milk breasts, when the opening is not at a depending part, and appears to be common in the fistula in ano; for it frequently happens that the ulceration goes on at first towards the gut; but before this has taken place, ulceration has gone on some way by the side of it, to bring the matter externally, which weight of matter is alone sufficient to continue the same process.

#### VII. *Of the Intention of Absorption of the Body in Disease.*

THIS, like every thing else in nature, involves in it two consequences, the one beneficial, the other hurtful; both of which this has in a considerable degree: however, if we understood thoroughly all the remote causes, we should probably see its utility in every case, and that these effects, however bad in appearance, yet are necessary, and of course in the end salutary. The use arising from what may

be called the natural absorption of parts, such as the forming or modelling process, as also the absorption of parts become unfit for the new mode of life, as the absorption of the thymus gland, etc. is involved in its necessity, and belongs to the natural history of the animal; but that arising from disease is directly to the present purpose. In the history I have just given, its use must, I apprehend, be evident; for we plainly see, in each mode of absorption, it often produces very salutary effects; and we may say, that although it often arises from disease, yet its operations and effects are often not at all a disease; and, probably, in those cases where we cannot assign a cause, as in wasting of parts, atrophy, etc. yet it is most probable that its use is considerable. It is likely, that under such a disease, or state of body, or parts, it would be hurtful to have them full and strong; where it produces a total waste of a part, its utility is probably not so evident; but in the progressive absorption, where it is leading bodies externally, or in consequence of suppuration, where it is bringing matter externally, its use is plain; or even in the formation of an ulcer, or the spreading of an ulcer, its use may be considerable. I have formerly called it the natural surgeon; and where it can do its business it is in most cases preferable to art: this is so evident



in many cases, that it has been a constant practice to attempt to promote it, in bringing abscesses to the surface, and in the exfoliation of bone, etc. and although not accounted for upon the principle of absorption, yet the effect was visible, and its use allowed.

### VIII. *The Modes of promoting Absorption.*

THE history that was given of the causes of absorption, in some degree explains the modes of promoting it; but as there were some natural causes which we cannot imitate, it is principally those that can be rendered useful that we are to take notice of in this place.

To promote absorption of the body itself, is no difficult operation; it is only to lessen the supply, and increase the waste, which last is often done by medicine; or to take such things as will render the supply less efficacious, as vinegar, or soap; but probably these act principally on the fat: to promote absorption of diseased parts, or parts increased, or parts newly formed, is not so easy a task, although the latter may be the most easy of the whole; for I have asserted, that newly formed parts are weaker in their living powers than the original formed parts; this, in some degree, gives us a

hint; for if we have a mode of producing a waste of the whole original body, under this general waste, new formed parts must suffer in a degree proportional to their weakness; and therefore will suffer a diminution in the same proportion; but this is too often not sufficient, or at least what would be sufficient for the disease would be too great for the constitution to bear: however, we find in particular cases that this practice has some effect; probably the best debilitating medicine is mercury, and it probably may act in more ways than one. It may promote absorption from a peculiar stimulus, producing necessity, or a state under which the parts cannot exist. Electricity, and most other stimulants, probably act in the same manner; for we find that violent inflammation is often a cause. Death in a part is sure to promote absorption, in order to produce a separation of the dead parts: and we even find that a part being diseased gives a tendency to separation, and only requires a considerable inflammation to promote it, such as warts coming away in consequence of inflammation. A diseased part has such power of giving the proper stimulus to the adjacent sound part, that if injured, or rendered dead in part by the application of a caustic, for instance, the sound part underneath will begin to relax, and shew more distinctly the limits or

boundaries of the disease; so that a separation of the diseased parts begins to take place, although the caustic has not reached nearly so far, and may give us an intimation of the extent of the disease, which we could not get before. It is in some measure upon this principle that arsenic removes tumours which extend beyond the immediate effect of the medicine.

Pressure is one of the causes of absorption in general, particularly the progressive, which, in the resolution of parts, is not the mode wanted; but it also assists in producing the interstitial, and if it could be made to produce the second of the interstitial, viz. absorption of the whole, as in the total decay of the thymus gland, then it would be sufficient in those cases where it could be applied: but the pressure must be applied with great care; for too much will either thicken or ulcerate, which last may be a mode of absorption we do not want: however, these effects will happen according to circumstances; for I have an idea, that entirely new formed parts, as tumours, will not be made to thicken by pressure, therefore may be pressed with all the force the natural surrounding parts will allow. On the other hand there are many cases where we would wish to prevent absorption; but when this is the case, we should be certain that the part which was to have been absorbed is such as

can be rendered useful afterwards; of which I have my doubts in many cases.

### IX. *Illustrations of Ulceration.*

Now that I have been endeavouring to give ideas of these effects of inflammation, viz. adhesion, suppuration, and ulceration, let me next mention some cases which frequently occur, as illustrations, which will give a perfect idea of these three inflammations: and, for the clearer understanding them, I shall illustrate them upon the inflammation, suppuration, and ulceration of the large circumscribed cavities. For instance, an inflammation attacks the external coat of an intestine; the first stage of this inflammation produces adhesions between it and the peritoneum lining the abdominal muscles: if the inflammation does not stop at this stage, an abscess is formed in the middle of these adhesions, and the matter acts as an extraneous body; the abscess increasing in size from the accumulation of matter, a mechanical pressure is kept up, which irritates, and the side next the skin is only susceptible of the irritation; this irritation not destroying the disposition to form matter, suppuration is still continued, and the ulcerative inflammation takes place.



If suppuration begin in more parts of the adhesions than one, they are commonly united into one abscess; an absorption of the parts between the abscess and the skin takes place, and the matter is led on to the external surface of the body, where it is at last discharged.

If the disposition for ulceration was equal on every side of the abscess, it must open into the intestine, which is seldom the case, although it sometimes does; for the same precautions are not taken here as in many other situations; for in some others, as in the nose, in the case of an abscess of the lachrymal sack, the passage is thickened towards the nose. In the case above-described, however, the abdominal muscles, fat, and skin, are removed, rather than the coats of the intestine. Cases of this kind have come under my own observation.

In this case, if adhesions had not preceded ulceration, the matter must have been diffused over the whole cavity of the belly; if the adhesive inflammation had not likewise gone before the ulceration in the abdominal muscles, etc. the matter would have found a free passage from the abscess into the cellular membrane of the abdomen, as soon as the ulceration had got through the first adhesions, as is often the case in erysipelatous suppurations.

Abscesses between the lungs and the pleura,

in the liver, gall-bladder, etc. rise to the surface from the same cause; also in lumbar abscesses, where one would at first imagine the readiest place of opening would be the cavity of the abdomen, or gut; the parts nearest to the skin are removed, and the matter passes out that way; however, in abscesses so very deep, it does not always happen that one side only is susceptible of the irritation, and we shall find that the matter is taking different courses.

Abscesses in the substance of the lungs sometimes differ from the above-described, for they sometimes open into the air-cells: it is, because the adhesive inflammation finds it difficult to unite the air-cells and branches of the trachea, (as was described in treating of that inflammation) and also in the substance of the lungs, it may be difficult to say where it can take a lead externally, from which, probably, the air-cells become similar to an external surface, and then ulceration takes place on that side of the abscess which is nearest to the cells; therefore we find that the matter gets very readily into the air-cells, and from thence into the trachea.

That the air-cells do not take on the adhesive state is evident in most abscesses in this part; for we find in most of those cases that the air-cells are exposed, as also the branches of the

trachea, and the parts of the lungs which compose this abscess have not the firmness and solidity which the adhesive inflammation generally produces in those parts where it takes place.

Thus too we find it going on in large abscesses, even after they have been opened, but are so situated or circumstanced as to have some part of the abscess on that side immediately under the skin pressed by some other part of the body which lies underneath. For instance, when a large abscess forms on the outer, and upper part of the thigh, opposite the great trochanter, which is a very common complaint, and an opening is made into it, or it bursts below, or on the side of that bone, but not directly opposite to the trochanter itself, in such cases it frequently happens, that the pressure of the trochanter on the inside of the abscess, viz. the cellular and adipose membrane, and the skin covering the trochanter, that this pressure produces ulceration of these parts; which process is continued on through the skin, and makes a second opening directly upon the trochanter.

It is curious to remark how these processes of nature fulfil their appointed purposes, and go on no further; for any young flesh, or granulations, which may have formed upon the tro-

chanter, which very often happens before this ulceration is completed, do not ulcerate, although the pressure was as great, or greater upon them than it was upon the parts which gave way.

This is upon the principle, that pressure from without has not the same effect as from within. The fistula laurimelis is another strong proof of ulceration only taking place towards the external surface, and securing the deeper seated parts; as also the ulceration in consequence of matter in the frontal sinuses.

An effect of the same kind we have observed in milk-breasts. In these cases the suppuration commonly begins in many distinct portions of the inflamed parts, so that it is not one large circumscribed abscess, but many separate sinuses are formed, all of which generally communicate: now it usually happens, that only one of these points externally; which being either opened or allowed to break, the whole of the matter is to be discharged this way; but it frequently happens, that the matter does not find a ready outlet by this opening, and then one or more of these different sinuses make distinct openings for themselves; which shews how very easily the slight pressure of such a trifling confinement of matter can produce the ulcerative inflammation. Ulceration is therefore



no more than an operation of nature to remove parts out of the way of all such pressure as the parts cannot support; and accordingly it begins where the greatest pressure is felt, joined with the nature of the parts and its vicinity to the skin.

It is curious to observe that the ulcerative process has no power over the cuticle, so that when the matter has got to that part it stops, and cannot make its way through, till the cuticle bursts by distention; but in general the cuticle is so thin as to give but very little trouble;<sup>f</sup>

<sup>f</sup> This is the reason why many abscesses in the palms of the hands, soles of the feet, fore part of the fingers, and about the nails, commonly called whitlows, etc. more especially in working people, give so much pain in the time of inflammation, and are so long in breaking, even after the matter has got through the cutis to the cuticle; the thickness of the cuticle, as also the rigidity of the nail, acting in those cases like a tight bandage, which does not allow them to swell or give way to the extravasation; for in the cuticle there is not the relaxing power, which adds considerably to the pain arising from the inflammation; but when the abscess has reached to this thick cuticle it has no power of irritation, and therefore acts only by distention; and this is in most cases so considerable, as to produce a separation of the cuticle from the cutis, for a considerable way round the abscess; for I observed, when on inflammation, that it commonly produced a separation of the cuticle; all of which circumstances taken together, make these complaints much more painful than a similar sized abscess in any other soft part. The application of poultices, in these cases, is of more benefit

however, in many places it is so thick as to be the cause of very troublesome consequences.

Thus far I have considered ulceration as arising from visible irritations, joined with a susceptibility of the parts for such particular irritation; but, besides those above-described,

than in any other, because here they can act mechanically, viz. the moisture being imbibed by the cuticle, as in a sponge, and thereby softening the cuticle, by which means it becomes larger in its dimensions, and less durable in its texture. These cases should be opened as soon as possible, to avoid the pain arising from distention, and the separation of the cuticle; when it is conceived it means to point at any one part, paring off the thick cuticle near the cutis, is allowing the matter to make its escape more readily, when it has got through the cutis. There is a circumstance which almost always attends the opening such an abscess, viz. the soft parts underneath push out through the opening in the cuticle, like a fungus, which, when irritated from any accident, give a greater idea of soreness perhaps than any other morbid part of the machine ever does: this is owing to the surrounding belts of cuticle not having given way to the increase of the parts underneath, by which means they are squeezed out of this small opening, like paint out of a bladder. It is a common practice to eat this down by escharotics, as if it was a diseased fungus; but this additional pain is very unnecessary, as the destroying a part which has only escaped from pressure, cannot in the least affect that which is within; and by simply poulticing till the inflammation, and of course the tumefaction, subsides, these protruded parts are gradually drawn into their original situations.

we often have instances of ulceration taking place from a disposition in a part, and where perhaps no reason can be assigned, but weakness in the part. I observed before, that some parts of the body were more susceptible of ulceration than others. I then spoke of original parts; but I now remark, that newly formed parts are much more susceptible of ulceration than the original; such as cicatrices, granulations, calluses, etc. for we find this disposition often taking place in old cicatrices from very slight causes; such as irregularity in the way of life, or violent exercise, which is seen every day in our hospitals, where the parts seem incapable of supporting themselves. Remarkable instances of this are recorded in Anson's Voyages, where the habit was so much debilitated, as to allow all the old sores to ulcerate, or break out anew: the calluses were absorbed and taken into the circulation; and we also find, that all these parts perform the operation of sloughing, when dead, much sooner than original parts.

Now it is evident, in these cases mentioned in Anson's Voyages, that the whole frame of body was weakened by the hardships suffered in this expedition; and that the young, or new formed substances would suffer in a greater

degree, arising from their being less firm and fixed than that which had been an original formation, and subsisted from the first; and, as no repaired parts are endowed with the powers of action or resistance equal to an original part, it is no wonder that this new flesh, sharing in the general debility, became incapable of supporting its texture: perhaps a very sense of this debility proved an irritation, or the cause of that irritation which produced the absorption of parts; however that may be, it is a general fact, that parts which are not originally formed commonly give way sooner in depravations of the habit: in like circumstances, also, old sores that are healing will break out, spread, and undo, in twenty-four hours, as much of the parts as had been healing in so many weeks.

All these observations tend to prove, that new formed parts are not able to resist the power of many diseases, and to support themselves under so many shocks, as parts originally formed; which will be still further illustrated, in treating of the power of absorption.

I observed that, although a part is losing ground or ulcerating, yet it continues suppurating; for while a matter-forming surface is ulcerating, (whether an original formed part of the body, such as in most abscesses, or a new



formed substance, such as granulations) we find that it still secretes pus.

In such cases the adhesive inflammation proceeds very rapidly, and would seem to prepare the parts as it goes for immediate suppuration the moment they are exposed.

## CHAPTER VII.

## GRANULATIONS.

WE come now to trace the operations of nature in bringing parts whose disposition, action, and structure, had been preternaturally altered, either by accident, or diseased dispositions, as nearly as possible, to their original state. In doing this we are to consider the constitution, and the parts as free from disease; because all actions which tend to the restoration of parts are salutary; the animal powers being entirely employed in repairing the loss, and the injury, sustained both from the cause, and arising from the course of the immediate effects, viz. inflammation, suppuration, and ulceration: now such operations cannot certainly be looked upon as morbid.

Nature having carried these operations for reparation so far, as the formation of pus, she, in such cases, endeavours immediately to set about the next order of actions, which is the formation of new matter, upon such suppurating surfaces as naturally admit of it, viz. where there has been a breach of solids, so that we

find, following, and going hand in hand with suppuration, the formation of new solids, which constitute the common surfaces of a sore. This process is called granulating, or incarnation; and the substance formed, is called granulation.

Granulations have, I believe, been generally supposed to be a consequence of, or always an attendant on suppuration: but the formation of granulations is not confined to a breach of solids where the parts have been allowed to suppurate, as either from accident, or a breach of the solids in consequence of an abscess, but it takes place under other circumstances; for instance, when the first and second bond of union has failed, as in simple fractures, which will be noticed hereafter.

Suppuration, I observed, arose in consequence of an injury having been done to the solids, so as to prevent them, for some time, from carrying on their natural functions; and I also observed that, it was immaterial whether this injury had exposed their surfaces, as in cases of accidents, and wounds, or whether the surfaces were not exposed, as in cases of abscesses in general; for in either of them, suppuration would equally take place; I likewise observed that, it was not necessary that there should be a breach in the continuity of parts for suppuration to take place in many cases, because all secret-

ing surfaces were capable of suppuration; but this last seems not to be so commonly the case with granulations. I believe that no internal canal will granulate, in consequence of suppuration, except there has been a breach of surface, and then it is not the natural surface which granulates, but the cellular membrane, etc. as in other parts.

Wounds that are kept exposed do not granulate till inflammation is over, and suppuration has fully taken place; for as the suppurative inflammation constantly follows when wounds come to be under such circumstances, it would seem to be in such cases a leading and necessary process for disposing the vessels to granulation.

Setting out then with the supposition that, this inflammation is in general necessary, under the above circumstances, for disposing the vessels to form granulations, we shall at once see how it may operate in the same manner, whether it arises spontaneously from the wound, the laceration of parts, mortification, bruise, caustic, or in short any other power which destroys or exposes the innumerable internal cells, or surfaces, so as to prevent their carrying on their natural functions.

Few surfaces, in consequence of abscesses, granulate till they are exposed; so that few or



no abscesses granulate till they are opened, either of themselves or by art; and therefore in an abscess, even of very long standing, we seldom or ever find granulations. In abscesses, after they have been opened, there is generally one surface that is more disposed to granulate than the others, which is the surface next to the centre of the body in which the suppuration took place. The surface next to the skin hardly ever has the disposition to granulate: indeed, before opening, its action was that of ulceration, the very reverse of the other: but, even after opening, that side under the skin hardly granulates, or at least not readily. I may further observe, that exposure is so necessary to granulation, even on such surfaces as arise from a broken continuity of parts, that if the abscess is very deep seated, they will not granulate kindly, without being freely exposed, which alone often becomes a cause why deep seated abscesses do not heal so readily, and often become fistulous.

Upon the same principle of granulations forming more readily upon that surface which is next to the centre, or opposite to the surface of the body, is to be considered their tendency to the skin. Granulations always tend to the skin, which is exactly similar to vegetation; for plants always grow from the centre of the

earth towards the surface; and this principle was taken notice of when we were treating of abscesses coming towards the skin.

### I. *Of Granulations, Independent of Suppuration.*

THE formation of granulations, I have observed, is not wholly confined to a breach made in the solids, either by external violence and exposure, or in consequence of a breach in the solids, which had been produced by suppuration and ulceration, and afterwards exposed; for parts are capable of forming granulations, or what I suppose to be the same thing, new animal matter, where a breach has been made internally, and where it ought to have healed by the first intention; but the parts being baulked in that operation, often do not reach so far as suppuration, so as to produce the most common cause of granulation. The first instance of the kind that gave me this idea, was in a man who died in St. George's Hospital.

January 1777. A man about fifty years of age, fell and broke his thigh-bone, nearly across, and about six inches above the lower end. He was taken into St. George's Hospital; the thigh was bound up, and put into splints, etc. The union between the two bones did not

seem to take place in the usual time. He was taken ill with a complaint in his chest, which he had been subject to before, and died between three and four weeks after the accident.

On examining the parts after death, there were found little or no effects of inflammation in the soft parts surrounding the broken bones, except close to the bones where the adhesive inflammation had taken place only in a small degree.

The bones were found to ride considerably, viz. near three inches.

The cavity made in the soft parts, in consequence of the laceration made by the riding of the bones, had its parieties thickened, and pretty solid, by means of the adhesive inflammation, although not so much as would have been the case, if the parts had been better disposed for inflammation: and some parts had become bony. There hardly was found within this cavity any extravasated blood, or coagulating lymph, except a few pretty loose fibres like strings, which were visibly the remains of the extravasated blood.

From these appearances this cavity had evidently lost its first bond of union, viz. the extravasated blood, which took place from the ruptured vessels, and probably the second had never taken place, viz. the coagulating lymph,

in consequence of the adhesive inflammation: however, there was an attempt towards an union, for the surrounding soft parts, we have observed, had taken on the adhesive, and ossific inflammation; so that in time there might have been formed in the surrounding soft parts a bony case, which would have united the two bones; but the parts being deprived of the two common modes of union, they were led to a third.

From the ends of the bones, and some parts of their surface, as well as from the inner surface of the soft parts, there was formed new flesh, similar to granulations.

The hollow ends of the bones were filled with this matter, which was rising beyond the common surface of the bone; and in some places adhesion had taken place between it and the surrounding parts, with which it had come in contact. The same appearance, which this new flesh had in this case, I have several times seen in joints, both on the ends of the bones, and on the inside of the capsular ligament, but never before understood how it was formed: hence we find that granulations can, and do arise in parts that are not exposed. This is what I have long suspected to be the case in the union of the fractured patella, and this fact confirms me more in that opinion.



Here then we are shewn, that the cause of granulation, or the forming of new flesh for union (independent of extravasation, or the adhesive inflammation) is more extensive in its effects than we were formerly acquainted with; and that granulations, or new flesh, arise in all cases from the first and second bond of union being lost in the part, (which indeed seldom happens, except from exposure) it therefore makes no difference, whether the first and second bond of union escape through an opening made in the skin, as in a compound fracture, or it loses its living powers, as in the present case, and as I suppose to be the case in a fracture of the patella, which obliges the absorbents to take it up as an extraneous body.

## II. *The Nature and Properties of Granulations.*

GRANULATIONS, and this new-formed substance, are an accretion of animal matter upon the wounded or exposed surface: they are formed by an exsudation of the coagulating lymph from the vessels, into which new substance both the old vessels very probably extend, and also entirely new ones form, so that the granulations come to be very vascular, and indeed they are more so than almost any other

animal substance. That this is the case, is seen in sores every day. I have often been able to trace the growth and vascularity of this new substance. I have seen upon a sore a white substance, exactly similar in every visible respect to coagulating lymph. I have not attempted to wipe it off, and the next day of dressing I have found this very substance vascular; for by wiping or touching it with a probe, it has bled freely. I have observed the same appearance on the surface of a bone that has been laid bare. I once scraped off some of the external surface of a bone of the foot, to see if the surface would granulate. I remarked the following day, that the surface of the bone was covered with a whitish substance, having a tinge of blue; when I passed my probe into it, I did not feel the bone bare, but only its resistance. I conceived this substance to be coagulating lymph, thrown out from inflammation, and that it would be forced off when suppuration came on; but on the succeeding day I found it vascular, and appearing like healthy granulations.

The vessels of granulations pass from the original parts, whatever these are, to the basis of the granulations; from thence towards their external surface, in pretty regular parallel lines, and would almost appear to terminate there.

The surface of this new substance, or granulations, continues to have the same disposition for the secretion of pus, as the parts from which they were produced; it is therefore reasonable to suppose, that the nature of the vessels does not alter by forming the granulations; but that they were completely changed for the purpose before the granulations began to form, and that these granulations are a consequence of a change then produced upon them.

Their surfaces are very convex, the reverse of ulceration, having a great many points, or small eminences, so as to appear rough: and the smaller these points are, the more healthy we find the granulations.

The colour of healthy granulations is a deep florid red, which would make us suspect that the colour was principally owing to the arterial blood;<sup>s</sup> but it only shews a brisk circulation in them, the blood not having time to become dark.

When naturally of a livid red, they are commonly unhealthy and shew a languid circulation, which appearance often comes on in

<sup>s</sup> I once began to suspect that the air might have some influence upon the blood, when circulating in the vessels, but from its losing that florid colour in sores of the legs by standing erect, I gave up that idea.

granulations of the limbs from the position of the body, as is evident from the following case:

A stout, healthy, young man, had his leg considerably torn, and it formed a broad sore; when healing it was some days of a florid red, and on others of a purple hue: wondering what this could be owing to, he told me, when he stood for a few minutes it always changed from the scarlet to the modena. I made him stand up, and found it soon changed: this plainly shews, that these new-formed vessels were not able to support the increased column of blood, and to act upon it, which proves that a stagnation of blood was produced, sufficient to allow of the change in the colour, and most probably both in the arteries and veins.

These sores never heal so fast as the others; whether it is occasioned by the position of the body, or the nature of the sore itself, but most frequently so in cases of the last-mentioned kind. As the position of the body is capable of producing such an effect, it shews us the reason why sore legs are so backward in healing, when the person is allowed to stand or walk.

Granulations, when healthy, and on an exposed or flat surface, rise nearly even with the surface of the surrounding skin, and often a little higher; and in this state they are always of a florid red; but when they exceed this, and



take on a growing disposition, they are then unhealthy, become soft and spongy, and without any disposition to skin. Granulations are always of the same disposition with the parts upon which they are formed, and take on the same mode of action. If it is a diseased part, they are diseased; and if the disease is of any specific kind, they are also of the same kind, and of course produce matter of the same kind, which I observed when on pus.

Granulations have the disposition to unite with one another when sound, or healthy; the great intention of which is, to produce the union of parts, somewhat similar to that by the first intention, or the adhesive inflammation, although possibly not by the same means.

The granulations having a disposition to unite with each other upon coming into contact, without the appearance of any intermediate animal substance, perhaps is in the following manner: when two sound granulations approach together, the mouths of the secreting vessels of the one coming to oppose the mouths of similar vessels of the other, they are stimulated into action, which is mutual; so that a kind of sympathetic attraction takes place, and as they are solids, the attraction of cohesion is established between them; this has been termed inosculation. The vessels thus joined, are altered from

secreting to circulating; or it may be in this way, viz. the circulatory vessels come to open upon the surface, and there unite with one another, and the two become one substance; or it may be asked, do they throw out coagulating lymph, when they come into contact, and have a disposition to heal? and does this become vascular, in which the vessels may inosculate, similar to union by the first, or second intention?

I have seen two granulations on the head, viz. one from the dura mater, (after trepanning) and the other from the scalp, unite over the bare bone which was between them, so strongly in twenty-four hours, that they required some force to separate them, and when separated they bled.

The inner surface of the cutis in an abscess, or sore, does not only not readily granulate, as has been mentioned, but it does not readily unite with the granulations underneath. The final intention of both seems to be, that the mouth of a sore which is seldom so much in a diseased state, should have a natural principle which attends disease, to put it upon a footing with the disease which is underneath; therefore, when abscesses are allowed to become as thin as possible before they are opened, this proportion between the sound skin and the disease

is better preserved, and the parts are not so apt to turn fistulous.

When the parts are unsound, and of course the granulations formed upon them unsound, we have not this disposition for union, but a smooth surface is formed somewhat similar to many natural internal surfaces of the body, and such as have no tendency to granulate; which continues to secrete a matter expressive of the sore which it lubricates, and in some measure prevents the union of the granulations. I imagine, for instance, that the internal surface of a fistulous ulcer is in some degree similar to the inner surface of the urethra, when it is forming the discharge commonly called a gleet. Such sores have therefore no disposition in their granulations to unite, and nothing can produce an union between them, but altering the disposition of these granulations by exciting a considerable inflammation, and probably ulceration, so as to form new granulations, and by these means give them a chance of falling into a sound state.

Granulations are not endowed with the same powers as parts originally formed. In this respect they are similar to all new-formed parts; and it is from this cause that changes for the worse are so easily effected. They more readily

fall into ulceration, and mortification, than originally formed parts; and from their readiness to ulcerate, they separate sloughs more quickly.

The granulations not only shew the state of the part in which they are formed, or the state in which they are themselves, but they shew how far the constitution is affected by many diseases. The chief of those habits which affect the granulations in consequence of the constitution, are, I believe, the indolent and irritable habits, but principally fevers; and these must be such as produce universal irritation in the constitution.

The unsound appearances of the granulations shew to what a stand the animal powers are put on such occasions, which does not appear so visibly in the originally formed parts; it is therefore evident, that the powers of the granulations are much weaker than those of the original parts.

### III. *Longevity of Granulations.*

GRANULATIONS are not only weaker in performing the natural or common functions of the parts to which they belong, but they would appear often to be formed with only stated periods of life, and those much shorter than the



life of the part on which they are formed. This is most remarkable in the extremities; but where they are capable of going through all their operations, as cicatrization, their life then seems to be not so limited: they are probably then acquiring new life, or longevity every day; but while in a state of granulation, we find them often dying without any visible cause: thus, a person shall have a sore upon the leg, which shall granulate readily, the granulations shall appear healthy, the skin shall be forming round the edges, and all shall be promising well, when all at once the granulations shall become livid, lose their life, and immediately slough off; or, in some cases, ulceration shall in part take place, and both together shall destroy the granulations; and probably where ulceration wholly takes place, it may be owing to the same cause. New granulations shall immediately arise as before, and go through the same process; this shall happen three or four times in the same person, and probably for ever, if some alteration in the nature of the parts be not produced. This circumstance of the difference in longevity of granulations in different people, is somewhat similar to the difference in longevity of different animals.

In cases of short-lived granulations, I have tried various modes of treatment, both local and

constitutional, to render the life of these granulations longer; but without success.

It would appear from what has been said of suppuration and granulations, that it is absolutely necessary they should take place in wounds which are not allowed to unite by the first intention, before union and cicatrization can take place. Although this in general is the case, yet in small wounds, such as considerable scratches, or where there is a piece of skin rubbed off, we find that by the blood being suffered to coagulate upon the sore, and form a scab, which is allowed to remain, the sore will only be attended by the adhesive inflammation, and will skin over without ever suppurating; where a small caustic has been applied, we find also, by allowing the slough to dry or scab, that when this is completed the scab will drop off, and the parts shall be skinned; but if the blood has not been allowed to coagulate and dry, or the slough has been kept moist, the sore will suppurate and granulate.

We even see in small sores, which are perfectly healthy, and suppurating, that if the matter be allowed to dry upon them, the suppuration will stop, and the skin form under the scab; the small-pox is a striking proof of this, which was fully treated of in a former part of the work.

A blister whose cuticle is not removed, is

similar to a scab. It does not allow of suppuration. If a separation takes place between the cutis and cuticle, and the cuticle be not removed, nothing will be collected through the whole course, and a new cuticle will be formed; but if the cuticle be removed, a greater degree of inflammation will come on, and suppuration will certainly take place.

#### IV. *Of the Contraction of Granulations.*

IMMEDIATELY upon the formation of the granulations, cicatrization would appear to be in view. The parts which had receded, in consequence of a breach being made into them, by their natural elasticity, and probably by muscular contraction, now begin to be brought together by this new substance; and it being endowed with such properties, they soon begin to contract, which is a sign that cicatrization is to follow. The contraction takes place in every point, but principally from edge to edge, which brings the circumference of the sore towards the centre; so that the sore becomes smaller and smaller, although there is little or no new skin formed.

The contracting tendency is in some degree proportioned to the general healing disposition

of the sore, and the looseness of the parts on which they are formed; for when it has not a tendency to skin, the granulations do not so readily contract, and therefore contracting and skinning are probably effects of one cause. The granulations too being formed upon a pretty fixed surface, which is a consequence of inflammation, are in some degree retarded in their contraction from this cause; but probably this does not act so much upon a mechanical principle as we at first might imagine; for such a state of parts in some degree lessens the disposition for this process, but this state is every day altering, and in proportion as the tumefaction subsides. Granulations are also retarded in their contraction, from a mechanical cause, when they are formed on parts naturally fixed, such as a bone; for instance, on the skull, the bone, etc. of the shin, for there the granulations cannot greatly contract.<sup>h</sup>

In cases where there has been a loss of substance, making a hollow sore, and the contraction has begun, and advanced pretty far, before the granulations have had time to rise as high as the skin, in such cases the edges of the skin are generally drawn down, and tucked in by it,

<sup>h</sup> This observation should direct us in operations on those parts, to save as much skin as possible.



in the hollow direction of the surface of the sore.

If it is a cavity, or abscess, which is granulating, with only a small opening, as in many that have not been freely opened, the whole circumference contracts, like the bladder of urine, till little or no cavity is left; and if any cavity is remaining, when they cannot contract any further, they unite with the opposite granulations, in the manner above-described.

This contraction in the granulations continues till the whole is healed, or skinned over; but their greatest power is at the beginning, at least their greatest effect is at the beginning; one cause of which is that, the resistance to their contraction in the surrounding parts is then least.

The contractile power can be assisted by art, which is a further proof that there is a resistance to be overcome.

The art generally made use of is that of bandages, which tend to push, draw, or keep the skin near to the sore which is healing; but this assistance need not be given, or is at least not so necessary, till the granulations are formed, and the contractile power has taken place; however, it may not be amiss to practise it from the very beginning, as by bringing the parts near to their natural position the adhesive inflamma-

tion will fix them there; they will therefore not recede so much afterwards, and there will be less necessity for the contractile powers of the granulations.

Besides the contractile powers of the granulations, there is also a similar power in the surrounding edge of the cicatrizing skin, which assists the contraction of the granulations, and is generally more considerable than that of the granulations themselves, drawing the mouth of the wound together like a purse; this is frequently so great, as to occasion the skin to grasp the granulations which rise above the surface, and is very visible in sugar-loaf stumps, where the projection of the sore is to be considered as above the level of the skin.

This contractile power of the skin is confined principally to the very edge where it is cicatrizing; and, I believe, is in those very granulations which have already cicatrized; for the natural, or original skin surrounding this edge does not contract, or at least not nearly so much, as appears by its being thrown into folds, and plaits, while the new skin is smooth and shining. This circumstance of the original surrounding skin not having the power of contraction, makes round wounds longer in healing than long ones; for it is much easier for the granulations, and the edge of the skin, to

bring the sides of an oblong cavity together, than the sides of a circle; the circumference of a circle not being capable of being brought to a point.

Whether this contraction of the granulations is owing to an approximation of all the parts, by their muscular contraction, like that of a worm, while they lose in substance as they contract; or if they lose without any muscular contraction by the particles being absorbed, so as to form interstices, (which I have called interstitial absorption) and the sides afterwards fall together, is not easily determined, and perhaps both take place.

The uses arising from the contraction of the granulations are various. It facilitates the healing of a sore, as there are two operations going on at the same time, viz. contraction and skinning.

It avoids the formation of much new skin, an effect very evident in all sores which are healed, especially in sound parts.

In amputation of a thick thigh (which is naturally seven, eight, or more inches diameter before the operation) the surface of the sore is of the same diameter; for the receding of the skin here does not increase its surface, as it does in a cut on a plane; yet in this case the cicatrix shall be no broader than a crown piece. This

can be effected by the contractile power of the granulations, for it is bringing the skin within its natural bounds.

The advantage arising from this is very evident, for it is with the skin, as it is with all other parts of the body, viz. that those parts which were originally formed are much fitter for the purposes of life than those that are newly formed, and not nearly so liable to ulceration.

After the whole is skinned, we find that the substance which is the remains of the granulations on which the new skin is formed, still continues to contract, till hardly any thing more is left than what the new skin stands upon. This is a very small part, in comparison with the first-formed granulations, and it in time loses most of its apparent vessels, becomes white, and ligamentous. For we may observe that, all new-healed sores are redder than the common skin, but in time they become much whiter.

As the granulations contract, the surrounding old skin is stretched to cover the part which had been deprived of skin, and this is at first little more than bringing the skin to its old position, which had receded when the breach was first made; but afterwards it be-



comes considerably more, so as to stretch, or oblige the old skin to elongate; from which we might ask the following question:

Does the surrounding skin in the healing of a sore lengthen by growth, or does it lengthen by stretching only? I think that the former is most probable; and if this is the case, I should call this process interstitial growth, similar to the growth of the ears of the people in the Eastern islands, particularly as it is an opposite effect to interstitial absorption.

Granulations appear to have other powers of action besides simply their economy tending to a cure. They have power of action in the whole, so as to produce other operations, and even to affect other matter. I conceive that a deep wound, such as a gun-shot wound, advanced to suppuration, and granulation, and also a fistula, becomes in some degree similar to an excretory duct, having the powers of a peristaltic motion from the bottom towards the opening externally. Thus we find that whatever extraneous body is situated at the bottom of the sore, is by degrees conducted to the skin, although the bottom of the sore, or fistula, is of the same depth. This effect in such sores does not arise from the granulations forming at the bottom, and gradually raising

the extraneous body as they form, (which is commonly the case with exfoliations and sloughs) but we find extraneous bodies come to the skin when the bottom of the wound is not granulating.

## CHAPTER VIII.

## OF SKINNING.

WHEN a sore begins to heal, we find that the surrounding old skin, close to the granulations (which had been in a state of inflammation, having probably a red shining surface, as if excoriated, and rather ragged) now becomes smooth, and rounded with a whitish cast, as if covered with something white, and the nearer to the cicatrizing edge, the more white it is. This is, I believe, a beginning cuticle, which appearance is probably as early a symptom of healing, and as much to be depended upon as any; so that the disposition in the granulations for healing is manifested in the surrounding skin; and while the sore retains its red edge all round, for perhaps a quarter, or half of an inch in breadth, we may be certain it is not a healing sore, and is what may be called, an irritable sore.

Skin is a very different substance, with respect to texture, from the granulations upon which it is formed; but whether it is an addi-

tion of new matter, viz. a new-formed substance upon the granulations being produced by them, or a change in the surface of the granulations themselves, is not easily determined. In either case, however, a change must take place in the disposition of the vessels, either to alter the structure of the granulations, or to form new parts upon them.

One would at first be inclined to the former of these opinions, as we have a clearer idea of the formation of a new substance, than such an alteration in the old. We find the new skin most commonly taking its rise from the surrounding old skin, as if elongated from it; but this is not always the case. In very large sores, but principally old ulcers, where the edges of the surrounding skin have but little tendency to contract, or the cellular membrane underneath to yield, as well as the old skin having but little disposition to skinning in itself, a cicatrizing disposition cannot be communicated from it to the nearest granulations by continued sympathy. In such cases new skin forms in different parts of the ulcer, standing on the surface of the granulations, like little islands. This, I believe, never takes place in parts the first time of their being sore, nor in sores which have a strong propensity to skin.

Skinning is somewhat like crystalization, it



requires a surface to shoot from, and the edge of the skin all round would appear to be this surface.

Whatever change the granulations undergo to form skin, they may in general be said to be guided to it by the surrounding skin, which gives this disposition to the surface of the adjoining granulations; as adjacent bones give an ossifying disposition to the granulations that are formed upon them. This may arise from sympathy; and if it does, I should call it continued sympathy. But when the old skin is unsound, and not able to communicate this disposition, then the granulations sometimes of themselves acquire it, and new skin begins to form where that disposition is strongest in them, so that the granulations may be ready to form new skin, if the surrounding skin be not in a condition to give the disposition. It would appear, however, that the circumference of the sore generally has the strongest disposition to skin, even although the surrounding skin does not assist; for in many old sores no new skin shall shoot from the surrounding skin, or be continued, as it were, from the old; and yet a circle of new skin shall form, making a circle within the old, and, as it were, detached from it.

Skinning is a process in which nature is always a great economist, without a single excep-

tion: this, however, may probably arise from the granulations being always of the nature of the parts on which they are formed, and from seldom being formed on parts that are the least of the nature of the skin, they have therefore no strong disposition to form skin. What would seem to make this observation more probable, is, that if the cutis is only in part destroyed, as by a hurt, or caustic, which has not gone quite through the cutis to the cellular membrane underneath, a new cutis will form immediately on the granulations, and in many cases it will form as fast as the slough will separate; the reason is, because the cutis has a stronger tendency to form cutis than any other part, and in many cases it may be said to form it from almost every point.

We never find that the new-formed skin is so large as the sore was, on which it is formed; this, I have already observed, is brought about by the contraction of the granulations, which in some measure is in proportion to the quantity of surrounding old skin, attended with the least resistance.

If the sore is in a part where the surrounding skin is loose, as in the scrotum, then the contractile power of the granulations being not at all prevented, but allowed full scope, a very little new skin is formed; whereas, if the sore

is on any other part, where the skin is not loose, such as the scalp, shin-bone, etc. in that case, the new skin is nearly as large as the sore.

This we find to be the case also, in parts which are so swelled as to render the skin tight, such as the scrotum, when under the distention of a hydrocele, and which sometimes happens where a caustic has proved ineffectual; we then find the new skin as extensive as in any other parts equally distended. The same thing takes place in white swellings of the joint of the knee; for if a sore is made upon such a part, as is frequently done by the application of caustics, we find that the new skin is nearly of the same size as the original sore. The general principle is also very observable after amputations of the limbs; for if much old skin has been saved, we find the cicatrix small, while on the other hand, if such care has not been taken, the cicatrix is proportionably large.

The new skin is at first commonly on the same level with the old, and if there has not been much loss of substance, or the disease is not very deep seated, it continues its position; but this does not appear to be the case with scalds and burns, for they frequently heal with a cicatrix, higher than the skin, although the granulations have been kept even with the skin. It would appear in these cases that a tumefac-

faction of the parts, which were the granulations, takes place after cicatrization.

Sometimes granulations cicatrize while higher than the common surrounding skin, but then they are such as have been long in that position, as is the case in some issues: I have seen the granulations surrounding a pea rise considerably above the skin, near half-a-crown in breadth, and skin over, all but the hole in which the pea lay, the whole looking like a tumour.

### I. *The Nature of the New Cutis.*

THE new-formed cutis is neither so yielding nor so elastic as the original is, and is also less moveable upon the part to which it is attached, or upon which it is formed. This last circumstance is owing to its basis being granulations, which are in some degree fixed upon parts united by the adhesive inflammation; and more particularly so, when the granulations arise from a fixed part, such as a bone; the new skin formed upon them being also fixed in proportion.

It is, however, constantly becoming more and more flexible in itself, and likewise more loosely attached, owing to the mechanical motion



to which the parts are subject afterwards. The more flexible and loose the parts become, it is so much the better, as flexibility, or the yielding of the parts, preserves it from the effects of many accidents. Parts which have been thickened in consequence of inflammation, such as the surrounding parts of new skin, have always a less internal power of action in them, than parts which have never been inflamed. This arises from the adventitious substance thrown out in the time of inflammation, being a clog upon the operations of the original; and the new matter not being endowed with the same powers, the part affected, taken as a whole, is by these means considerably weakened.

Motion given to the part so affected, must be mechanical; but that motion becomes a stimulant to the parts moved, that they cannot exist under such motion without adapting the structure of the parts to it, and this sets the absorbents to work, or they receive the stimulus of necessity, and absorb all the adventitious or rather superfluous substance; by which means the parts are as much as possible reduced to their original texture.

Medicines have not the powers we could wish in many such cases; mercury, however, appears to have the power of producing a similar

stimulus to motion, and should be made use of where a mechanical stimulus cannot be applied; and, I believe, when joined with camphire, its powers of producing absorption are increased; when both medicine and mechanical means can be used, so much the more benefit will ensue.

When every thing else fails, electricity might be tried. It has been the cause of absorption of tumours. It has reduced the swellings of many joints in consequence of sprains, and thereby allowed of the freedom of motion.

The new-formed cutis is at first very thin and extremely tender, but afterwards becomes firmer and thicker: it is a smooth continued skin, not formed with those insensible indentations which are observed in the natural or original skin, and by which the original admits of any distention the cellular membrane will allow of, as is experienced in many dropsies, white swellings in the joints, etc. This is proved by steeping a piece of dead skin, with a cicatrix in it, in water to make the cuticle separate from the cutis; there we find that the new-formed cuticle becomes but little larger by such a process, which plainly shews, that the new-formed cutis upon which this cuticle was

formed, has a pretty smooth continued surface, and not that soft unequal surface which distinguishes the original cutis.

This new cutis, and indeed all the substance which had been formerly granulations, is not nearly so strong, nor endowed with such lasting and proper actions, as the originally formed parts. The living principle itself is also not nearly so active; for when an old sore once breaks out, it continues to yield till almost the whole of the new-formed matter has been absorbed or mortified; as has been already explained.

The young cutis is extremely full of vessels, which afterwards, in a great measure, either become lymphatic or impervious, or are taken into the constitution, so that the skin and granulations underneath are at last free from visible vessels, and become white.

The surrounding original cutis, being drawn towards a centre by the contraction of granulations, to avoid as much as possible the formation of new skin is thrown into loose folds, while the new looks like a piece of skin upon the stretch, and the whole appears as if a piece of skin had been sewed into a hole by much too large for it; and therefore it had been necessary to throw the surrounding old skin into folds,

or gather the surrounding skin, in order to bring it in contact with the new. The new cutis of a sore, I believe, never acquires a muscular structure; nor does it grow larger than the sore which it covers, so as to be thrown into wrinkles similar to the old; and therefore has always that stretched, shining appearance.

## II. *Of the New Cuticle.*

It does not appear to be so difficult a process for the cutis to form cuticle, as it is for the granulations to form cutis; for we find in general, that wherever there is a new cutis formed, it is covered with a cuticle: and in cases of blisters, or any other cause which may have deprived the cutis of its cuticle, we find that the cuticle is soon restored. We are to observe, however, that in such cases it is a sound, original cutis, forming its own cuticle, and having the whole power of forming the cuticle, the surrounding cuticle itself having no power of action of this kind: every point of cutis is forming cuticle, so that it is forming equally every where at once; whereas I ob-



served, that the formation of the cutis was principally progressive from the surrounding cutis.

It is at first very thin, and partakes more of a pulpy than a horny substance; as it gets stronger, it becomes smooth and shining, and is much more transparent than original cuticle, which shews more the colour of the rete mucosum. This account relates to the cuticle of sound parts which had gone through all the operations of health, but where there is a retardation in the healing we find that the cuticle is, in some cases, backward in forming, and in others it shall be formed very thick, so as to make it necessary to be removed, it appearing to be a clog upon the cutis, retarding the progress of its formation.

### III. *Of the Rete Mucosum.*

THE rete mucosum is later in forming than the cuticle, and in some cases never forms at all: this is best known in blacks, who have been either wounded or blistered, for the cicatrix in the black is a considerable time before it becomes dark; and in one black who came under my observation, a sore which had been

upon his leg when young, remained white when he was old. After blisters too, the part blistered remains white for some time after the cuticle is completely formed: however, in many cicatrices of blacks, we find them even darker than any other part of the skin.

## CHAPTER IX.

*EFFECTS OF INFLAMMATION, AND ITS CONSEQUENCES ON THE CONSTITUTION.*

THE constitutional affections arising from inflammation are immediate, and remote.

The immediate affections have been already considered, viz. the sympathetic fever, and also the nervous. I shall now treat of the remote, viz. the hectic, and dissolution, which arise from the state of the local affection at the time; the inflammation not being able to go through all the salutary steps that have been described. We have diseases, however, sometimes accompanying those salutary processes, although we should naturally conclude, from the foregoing account, that the suppurative inflammation and suppuration itself should produce no change in the constitution, but what was attendant upon the inflammation, and might be supposed, perhaps, somewhat necessary to it; and that when inflammation had subsided, and a kind suppuration come on, the constitution should be left in a sound state, because it would now appear that all the future processes were settled, and a

constitution that was capable of doing this, was also capable of going through all the succeeding operations, as they are only actions of restoration; but we find sometimes the contrary, and the condition in which the constitution is either left, or which it afterwards takes on, proves often much more hurtful than the inflammation itself.

It appears in many cases, that the inflammation, the attendant fever, the going off of these, and the commencement and continuance of the suppuration, produce in many persons a change in the constitution, giving a disposition to symptoms, which are called nervous. The locked jaw is often the effect of this leading cause, as well as hysterics, spasms, upon the muscles of respiration, and great restlessness, which often prove fatal to the patient; there are, likewise, signs of great and universal debility, or signs of dissolution in the patient, all of which appear to be increased by a continuance of the suppuration. Each of these diseases are well marked, and it would appear that the locked jaw, hysterics, spasms, and great restlessness, are of the nervous kind, and do not appear to arise from such a constitution, as is not equal to overcome the cause; for the cause which produced them being removed, the effects are going on towards health now, as well as before;



and if the patient dies of any of those diseases, it is not from the cause, nor from the immediate effect, viz. the local disease, but from the effect which the preceding operations, joined with the healing, have on some constitutions. They all seem to derive their origin from the same root, viz. from all the foregoing processes, which we have been describing; but they are altogether too extensive for our present subject.

### I. *Of the Hectic.*

I HAVE now described the injuries of which inflammation is a consequence; the progress of that action in different parts; its effects on the constitution; together with the mode of treatment of both, and have carried it through its various steps to a perfect restoration. I have also already mentioned, that the act of absorption affects some constitutions; but I shall now take notice, that nature is not always equal to those salutary processes, and hence the constitution sometimes becomes particularly affected, producing symptoms different from those formerly described, and which have been called the *hectic*.

This disease is one of our remote constitutional sympathetic affections, and appears to

arise from a very different origin from the other sympathizing effects beforementioned. When it is a consequence of a local disease, it has commonly been preceded by the first process of the former, viz. inflammation and suppuration, but has not been able to accomplish granulation and cicatrization, so as to complete the cure. It may be said to be a constitution now become affected with a local disease or irritation, which the constitution is conscious of, and of which it cannot relieve itself, and cannot cure; for while the inflammation lasts, which is only preparatory, and an immediate effect of most injuries, and in parts which can only affect the constitution, so as to call up its powers, there can be no hectic.

We should distinguish well between a hectic arising from a local complaint entirely, where the constitution is good, but only disturbed by too great an irritation; and a hectic arising principally from the badness of the constitution, which does not dispose the parts for a healing state; for in the first it is only necessary to remove the part (if removable) and then all will do well; but in the other we gain nothing by a removal, except the wound made by the operation is much less, and much more easily put into a local method of cure; so that this bad constitution falls less under this, (the opera-

tion taken into the account) than under the former state; but all this depends on nice discrimination.

The hectic comes on at very different periods after the inflammation, and commencement of suppuration, owing to a variety of circumstances. First, some constitutions much more easily fall into this state than others, having less powers of resistance. The quantity of incurable disease must be such as can affect the constitution, and in whatever situation, or in whatever parts, it will be always as to the quantity of disease in those situations or parts in the constitution, which will make the time to vary very considerably. In many diseases it would appear, from the manner of coming on, that they retard the commencement of the hectic, such as lumbar abscesses. But when such abscesses are put into that state, in which the constitution is to make its efforts towards a cure, but is not equal to the task, then the hectic commences.

It takes its rise from a variety of causes, but which I shall divide into two species, with regard to diseased parts, viz. the parts vital, and the parts not vital. The only difference between these two, is, probably, merely in time, with respect to its coming on, and its progress when come on: but what is very similar to

the disease of a vital part, is quantity of incurable disease.

The causes of hectic, arising from diseases of the vital parts, may be many, of which a great proportion would not produce the hectic if they were in any other part of the body; such, for instance, as the formation of tumours, either in, or so as to press upon some vital part, or a part whose functions are immediately connected with life. Schirri in the stomach, mesenteric glands, which tumours any where else would not produce the hectic; many complaints too of vital parts, as diseased lungs, liver, etc. all of these produce the hectic, and much sooner than if the parts were not vital. In many cases where those causes of the hectic come on quickly, it frequently follows so quick upon the sympathetic fever, that the one seems to run into the other: this I have often seen in the lumbar abscess. They also produce symptoms according to the nature of the part injured, as coughs, when in the lungs; sickness and vomiting, when in the stomach; and probably bring on many other complaints, as dropsies, jaundice, etc. but which are not peculiar to the hectic.

When the hectic arises from a disease in a part not vital, it sooner or later commences, according as it is in the power of the parts to



heal, or continue the disease. If far from the source of the circulation, with the same quantity of disease, it will come on sooner. When in parts not vital, it is generally in those parts where so great a quantity of disease can take place, (without the power of being diminished in size, as is the case with the diseases in most joints<sup>i</sup>) as to affect the constitution, and also in such parts as have naturally but little powers to heal; we must at the same time include parts that are well-disposed to take on such specific diseases as are not readily cured in any situation; such parts are principally the larger joints, both of the trunk and extremities; but in the small joints of the toes and fingers, although the same local effects take place, as in the larger, yet the constitution is not made sensible of it; we therefore find a scrofulous joint of a toe or finger going on for years, without affecting the constitution.

The ankle, wrist, elbow, and even the shoulder, may be affected much longer than either the knee, hip-joint, or loins, before the constitution sympathizes with their want of powers to heal.

<sup>i</sup> The cavity of a joint is such, as not readily to become smaller under disease, as in the soft parts, which was described in the contraction of sores.

Although the hectic commonly arises from some incurable local disease of a vital part, or of a common part when of some magnitude, yet it is possible for it to be an original disease in the constitution: the constitution may fall into the same mode of action, without any local cause whatever, at least that we know of.

Hectic may be said to be a slow mode of dissolution: the general symptoms are those of a low, or slow fever, attended with weakness, but more with the action of weakness than real weakness; for, upon the removal of the hectic cause, the action of strength is immediately produced, as well as every natural function, however much it was decreased before.

The particular symptoms are debility; a small, quick, and sharp pulse; the blood forsaking the skin; loss of appetite; often rejection of all aliment by the stomach; wasting; a great readiness to be thrown into sweats; sweating spontaneously when in bed; frequently a constitutional purging; the water clear.

This disease has been, and is still in general laid to the charge of the absorption of pus into the constitution from a sore; but I have long imagined that an absorption of pus has been too much blamed as the cause of many of the bad symptoms which frequently attack people who have sores.

First, this symptom almost constantly attends suppuration when in particular parts, such as the vital parts, as well as many inflammations before actual suppuration has taken place, as in many of the larger joints, called white swellings; while the same kind and quantity of inflammation and suppuration in any of the fleshy parts, and especially such of them as are near the source of the circulation, have in general no such effect; in those cases, therefore, it is only an effect upon the constitution produced by a local complaint, having a peculiar property, which I shall now consider.

I observed, that with all diseases of vital parts, the constitution sympathized more readily than with diseases of any other parts; and also, that all diseases of vital parts are more difficult of cure in general than those which are not vital. I have observed, likewise, that all the diseases of bones, ligaments, and tendons, affected the constitution more readily than those of muscles, skin, cellular membrane, etc. and we find that the same general principles are followed in the universal remote sympathy, produced by local diseases of those parts.

When the disease is in vital parts, and is such as not to kill by its first constitutional effects, the constitution then becomes teased with a complaint which is disturbing the neces-

sary actions of health, the parts being vital; there is, besides, the universal sympathy, with a disease which gives the irritation of being incurable.

In the large joints it continues to harass the constitution with a disease, where the parts have no power, or what is more probable, have no disposition to produce a salutary inflammation and suppuration; the constitution, therefore, is also irritated with an incurable disease.

This is the theory of the cause of the hectic, which will be further illustrated: but now let us consider how far the idea of the absorption of matter may be a cause.

If the absorption of matter always produced such symptoms, I do not see how any patient, who has a large sore, could possibly escape this disease; because we have as yet no reason to suppose, that any one sore has more power of absorption than another.

If in those cases where there is an hectic constitution, the absorption is really greater than when the habit is healthy, it will be difficult to determine whether this increase of absorption is a cause, or an effect.

If it be a cause, it must arise from a particular disposition in the sore to absorb more at one time than common, even while it was in a healthy state; for the sore must be healthy and



then absorb, which hurts the constitution; moreover, as the sore is a part of that constitution, it must of course be affected in turn; and what reason we have to suppose that a healthy sore of a healthy constitution should begin to absorb more at one time than another, I must own I cannot discover. If this increase of absorption does not depend upon the nature of the sore, it must then take its rise from the constitution; and if so, there is then a peculiarity in the constitution, so that the whole of the symptoms cannot arise entirely from the absorption of matter as a cause, but must depend on a peculiar constitution, and absorption combined.

If absorption of matter produced such violent effects as are commonly ascribed to it, (which, indeed, are never of the inflammatory kind, but of the hectic) why does not the venereal matter do the same? We often know that absorption is going on by the progress of buboes; and I have known a large bubo, which was just ready to break, absorbed from a few days sickness at sea, while the person continued at sea for twenty-four days after; yet, in such cases, no symptoms appear till the matter begins to have its specific effects, and these very symptoms are not similar to those which are called hectic. From reasoning, we ought to expect that the venereal matter would act with greater

violence than the common matter from a healthy sore. Although matter too is frequently formed on the inside of the veins, in cases of inflammation of their cavities,<sup>k</sup> and this matter cannot fail of getting into the circulation, yet in these cases we have not the hectic disposition, but only the inflammatory, and sometimes death. We likewise find very large collections of matter, which have been produced without visible inflammation, such as many of the scrofulous kind, and which are wholly absorbed, even in a very short time, yet no bad symptoms follow.<sup>1</sup>

We may, therefore, from hence conclude, that the absorption of pus from a sore into the circulation, cannot be a cause of so much mischief as is generally supposed; and if it was owing to matter in the constitution, I do not see how these symptoms could ever cease, till suppuration ceased, which does not readily happen in such constitutions, their sores being tedious in healing. We find, however, that such patients often get well of the hectic before suppuration ceases, even when no medicine was given; and in the case of veins, there is great

<sup>k</sup> Vide Transactions of a Society for the Improvement of Medical and Chirurgical Knowledge.

<sup>1</sup> It may, however, be objected to this, that this is not true matter, or pus; but it may be necessary to shew, that the one affects the constitution upon absorption more than the other.

reason to believe, that after all the bad symptoms are removed, suppuration is still going on, as we find it so in a sore; pus may, therefore, still pass into the constitution from the veins, and yet the hectic may not be produced, which would certainly be the case if those bad symptoms were occasioned by the matter getting into the circulation.

But I very much doubt the fact of absorption going on more in one sore than another; and if ever it does I think it is of no consequence; I am much more inclined to believe, that this hectic disposition arises from the effect which irritation of a vital organ, and some other parts, such as joints, (being either incurable in themselves, or being so to the constitution for a time) have on the constitution.

We may remark, that in large abscesses which have not been preceded by inflammation, the hectic disposition seldom or never comes on till after they are opened, (although they may have been forming matter for months); but in such cases, the disposition often comes on soon after opening, and in others, very late. Till the stimulus for restoring parts is given, no such effect can take place; and if the parts are well-disposed to heal no hectic disposition comes on, neither is the constitution at all affected. In diseased joints, also, which are attended with

inflammation, if the parts were capable of taking on a salutary inflammation, we should have only the first sympathetic fever; but as they seldom are capable of doing this, the constitution becomes teased with a complaint, not taking on the immediate and salutary steps towards a cure. In the venereal disease, too, where we know that the venereal matter has got into the constitution, and that the matter is producing its specific effects, yet no hectic comes on, till the constitution is harassed with an incurable disease, and this not till long after all the parts are healed, with regard to recent disease, and no matter is formed for further absorption. That absorption does take place in sores, we have reason to believe, and upon this fact, a mode of dressing sores has been advised. The following is a remarkable instance of it in a bubo: a young man had a chancre and three buboes, one of which appeared when the other two were almost cured. This was very large, and at the bottom of the belly. When it had suppurated, and was pretty near breaking, it diminished very quickly, and in two or three days was entirely gone. While this was going on, he observed his urine wheyish and thick, while making it, which went entirely off when the bubo had subsided. Before the bubo began to subside, he was rather mending in his health, which conti-



nued to mend, nor did the diminution of the bubo alter the state of his health.

The hectic, from what has been said, appears in some measure to depend on the parts being stimulated to produce an effect which is beyond their powers: that this stimulus is sooner or later in taking place in different cases, and that the constitution becomes affected by it. The hectic disposition arises from diseased lungs, lumbar abscesses, white swellings, scrofulous joints, etc.

## II. *The Treatment of the Hectic.*

WE have as yet, I am afraid, no cure for any of the consequences above related; I believe that depends in the cure of the cause, viz. the local complaint, or in its removal; the effects, I fear, are not to be cured. Strengtheners, and what are called antiseptics, are recommended.

Strengtheners are proposed on account of the debility which has taken place.

Antiseptics have been employed from an idea that pus, when absorbed, gives the blood a tendency to putrefaction. To prevent both of these effects from taking place, the same medicines are however recommended. These are bark and wine.

Bark will, in most cases, only assist in supporting a constitution. I should suppose it impossible to cure a disease of the constitution till the cause be removed; however, it may be supposed that these medicines may make the constitution less susceptible of the disease, and may also contribute to lessen the cause, by disposing the local complaints to heal: but where the hectic arises from specific disease; as, for instance, if a hectic disposition comes on from a venereal disposition, bark will enable the constitution to support it better than it otherwise could have done, but can never remove it.

Wine, I am fearful, rather does harm if it increases the actions of the machine without giving strength, a thing carefully to be avoided: however, I have not yet made up my mind about wine.

When the hectic arises from local diseases, in such parts as the constitution can bear a removal of, then the diseased part should be removed, viz. when it arises from some incurable disease in an extremity, and although all the symptoms above-described should have already taken place, we shall find, that upon a removal of the limb the symptoms will abate almost immediately. I have known a hectic pulse at one hundred and twenty sink to ninety in a few hours, upon the removal of the hectic cause.

I have known persons sleep sound the first night without an opiate, who had not slept tolerably for weeks before. I have known cold sweats stop immediately, as well as those called colliquative. I have known a purging immediately stop, upon the removal of the hectic cause, and the urine drop its sediment. It is possible too, that the pain in the operation, and the sympathetic affection of the constitution may assist in these salutary effects. It is an action diametrically opposite to the hectic, and may be said to bring back the constitution to a natural state.

### III. *Of Dissolution.*

DISSOLUTION is the last stage of all, and is common to, or an immediate consequence of all diseases, whether local or constitutional. A man shall not recover of a fever, whether original or sympathetic, but shall move into the last stage, or dissolution. It shall take place in the second stage of a disease, where the state of constitution and parts appears to be formed out of the first; as for instance, a man shall lose his leg, especially if above the knee; or have a very bad compound fracture in the leg; the first constitutional symptoms shall have been violent, but all

shall appear to have been got the better of, and there shall be hopes of recovery, when suddenly he shall be attacked with a shivering fit, which shall not perform all its actions, viz. shall not produce the hot fit and sweat, but shall continue a kind of irregular hot fit, attended with loss of appetite, quick, low pulse, eyes sunk, and the person shall die in a few days. Or he shall go into the common diseased symptoms of the second stage, viz. the nervous, with many of its effects, as the tetanus, and dissolution shall also be a consequence. Or if the local disease does not or cannot heal, and is such as to affect the constitution, it then brings on the hectic, and sooner or later dissolution takes place; for the hectic is an action of disease, and of a particular kind; but dissolution is giving way to disease of every kind, therefore has no determined form arising from the nature of the preceding disease.

It has been supposed, that this disease arises also from the absorption of matter. It appears to be in many cases an effect arising from violent and long continued inflammations and suppurations, although not incurable in themselves; (therefore, in those respects, not similar to the hectic) and which in many instances are known to produce the greatest changes in the constitution. Such often arise



from very bad compound fractures, from amputations of the extremities, especially the lower, and more particularly the thigh, in which cases the sympathetic fever has run high, which would appear to be necessary, or preparatory; but in the hectic, it is not necessary that the constitution should have suffered at all in the first stages of the disease; dissolution seems to be more connected with what is past, than with the present alone, which is the reverse of the hectic. We never find this disease take place in consequence of small wounds, or such wounds as have affected the constitution but little in its first stages; but which may affect the constitution much in its second, such as small wounds producing the locked jaw. It would appear to take place in our hospitals more generally than in private houses, and more readily in large cities than in the country. We shall find that the hectic and this are by no means the same disease, differing exceedingly in their causes, and in many of their effects; for in the cases of compound fractures and amputations, we find the constitution often capable of going through the inflammatory and sympathetic fever, producing suppuration and granulation, as well as continuing the production of these for some time, yet sinking under them at last, and often immediately, without a seeming cause. This

effect will more readily take place, if the person was in full health before the accident or operation, than if he had been somewhat accustomed to the other, or true hectic; for the symptoms of dissolution seldom or never take place, if the violence committed has been to get rid of a hectic cause. It sometimes takes place early, in consequence of local injury, and would seem to be a continuation of the sympathetic fever; as if the constitution was not able to relieve itself of the general affection, or that the parts could not go into the true suppurative disposition. We see this frequently after removing a limb, especially in the lower extremity, and after cutting for the stone in very fat men, above the middle age, and who have lived well.

The first symptoms are generally those of the stomach, which produce shivering: vomiting immediately follows, if not an immediate attendant; there is great oppression and anxiety, the persons conceiving they must die. There is a small quick pulse; perhaps bleeding from the whole surface of the sore, often mortification, with every sign of dissolution in the countenance; as it arises with the symptoms of death, its termination is pretty quick. Here is a very fatal disease taking place; in some almost immediately, when all appeared to be within the power of the machine, and therefore cannot im-

mediately arise from the sore itself; for it is very common after such operations as usually do well; but the hectic always takes place in consequence of those sores which seldom or never get well in any case; yet the sore certainly assists in bringing on dissolution, because we never see the disease take place when the sore is healed; nor in those where the constitution seems not to be equal to the task, as is the cause of the hectic.

The hectic is much slower in its progress, and seems to be a simple and an immediate effect, arising from a continued cause which is local; by removing the cause, therefore, the effect ceases, and the havoc made upon the constitution is soon restored; persons, therefore, do much better in consequence of the hectic having in some degree taken place, prior to the removal of the cause. But dissolution is a change of the constitution in consequence of causes which now do not wholly exist, and in many cases it does not take place till the constitution appears to be capable easily of performing all its functions, and a removal of the parts does not relieve, as in the hectic; for dissolution does not depend for its continuance upon the presence of the disease.

Death or dissolution, appears not to be going on equally fast in every vital part; for

we shall have many people very near their termination, yet some vital actions shall be good, and tolerably strong; and if it is a visible action, and life depends much upon this action, the patients shall not appear to be so near their end as they really are: thus I have seen dying people whose pulse was full and strong as usual, on the day previous to their death, but it has sunk almost at once, and then become extremely quick, with a thrill: on such occasions it shall rise again, making a strong effort, and after a short time, a moisture shall probably come on the skin, which shall in this state of pulse be warm; but upon the sinking of the pulse, shall become cold and clammy: breathing shall become very imperfect, almost like short catchings, and the person shall soon die.

It would appear in many cases, that disease has produced such weakness at last, as to destroy itself: we shall even see the symptoms, or consequences of disease, get well before death. A gentlewoman, who was above seventy-five, was anasarcous all over: the abdomen was very full and large; she made but very little water; her breathing was so difficult as to make her purple in the face, so that most probably there was water in the chest; her pulse was extremely irregular; fluttering, trembling, intermitting and small. Her legs were punctured with a lancet,



and discharged very freely for more than three weeks, which emptied the cellular membrane of the body, as well as in some degree the abdomen; the breathing became free and easy, so that we supposed the water in the chest was absorbed; the pulse became regular, soft, and fuller, and the appetite in some degree mended; in which state she seemed free from disease, having only some of the consequences still remaining. The quantity of urine increased to the natural quantity; but notwithstanding actual disease seemed to be gone, yet she became weaker and weaker, in which state she existed for near a month, and died. Some days prior to death, a purple and then a livid appearance came upon the legs, with some spots of extravasated blood above where the punctures had been made, on which blisters arose, at first filled with serum, then with bloody serum, all of them threatening mortification.

Even when in the state of approaching death, we often find a soft, quiet, and regular pulse, having not the least degree of irritability, in it, and this when there is every other sign of approaching death; such as entire loss of appetite, no rest, hickup, the feet cold, and partial cold, clammy sweats, etc.

A lady appeared to have lost all diseased action, only the consequences of disease remain-

ing, viz. weakness, with swelled legs; she made little or no water; at length she became so weak, as hardly to articulate; she lay in a kind of doze, was only roused to impression, and only took food by spoonfuls when desired; the pulse so small as hardly to be felt: her extremities were cold, and she had all the signs of approaching dissolution, which took place; yet within thirty-six hours before she died, the whole water in her legs and thighs was taken up, her urine increased, and about ten hours previous to her death, the legs, etc. were as small as ever. As I consider the dropsy to be a disease, and not simply weakness, which this case would in some measure shew from the result, I should wish to ask, whether the absorption of water was not owing to the disease being gone, and whether the disease being gone, the absorbents did not set to work? If so, then dissolution may be a cessation of disease, and persons die of weakness simply; or simply, either the want of powers to act, or the want of that stimulus of necessity to act, by which means a cessation of action takes place.

Since bodies of persons who die suddenly, and even by violent death, as well as those who die soon after a considerable operation, are not capable of being preserved so long as those who have been ill for some time; and as those who

have a considerable operation performed upon them, as the amputation of a leg, do not so readily recover as those who have been long ill, may not the more ready production of death, and the more ready production of putrefaction be owing to the same principle? one more readily running into the action of death, as also more readily into the action of putrefaction; but it is very probable that the action producing quick putrefaction, is an action prior to absolute death.

## PART III.

### CHAPTER I.

#### *THE TREATMENT OF ABSCESSSES.*

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I HAVE endeavoured to lay down the general principles of suppuration, which principles of themselves lead to a general method of cure; but as it is only the proper application of art to those principles which completes the surgeon, and since it is the most difficult part to apply our knowledge of first principles to practice with readiness, especially when there appear some peculiarities, it will be necessary to bring the beginner from first principles to the practical part.

Abscesses are in general consequences of spontaneous inflammation, but not always so; for they may be consequences of some violence, as strains or bruises from some external violence, which has hurt deeper seated parts than the skin



over them, which inflame and form an abscess, as was described in treating of accidents; as also from the introduction of extraneous bodies, over which the parts have healed. Even when they appear to be spontaneous, they arise from so many causes, and from thence have so many dispositions, or are of so many kinds, that in general they become one of the greatest objects in surgery; because, from these circumstances, they require a vast variety in the manner of treatment.

I do not mean at present to enter into a full discussion of the cause, effect, and cure of every abscess, because that would be treating of every disease which is capable of producing such complaints, many of which would come under the article of specific diseases, which must be treated of separately; yet I mean here to lay down such general surgical rules for their treatment and many of their consequences, as will include almost every kind of disease of this kind, considered as an abscess simply; so that the specific treatment of any specific abscess will be principally confined to the medicinal treatment of the part and the constitution; thereby the treatment of the local complaint so produced, abstracted from the specific disposition, will for the most part come under our general rules.

As most spontaneous suppurations, from whatever cause, are deeper seated than the surface of the body, such of course must form what are called abscesses, or collections of pus; therefore we have abscesses of all depths, from the pimple in the skin to the boil; and from the boil to deep-seated abscesses, among the muscles, or in any other deep-seated part.

Abscesses are commonly formed where matter is found, especially the more superficial ones, and such may be justly called abscesses of this part; but collections of matter are often found in parts where not formed, more especially in the deeper-seated ones, the matter moving from the seat where it was formed to some more depending part, or having met with some obstruction in its course, it takes another direction, and therefore may be called an abscess in this part; and I shall call them so in my descriptions of them. I believe such abscesses do not arise from inflammation, but are of the scrofulous kind, and therefore not so much to our present purpose.

It will be difficult to divide abscesses into absolutely distinct classes; but, similar to inflammation, they may be divided into two kinds, the sound and the unsound; for I imagine these two first principles might lead to the method of

cure; but at present I only mean to lay down the principles of an abscess.

The appearances which distinguish the sound from the unsound abscess are several; although there are many abscesses of particular kinds that give little or no information. They often differ from one another in their first appearance, from the kind of inflammation, as also in their course, but more particularly in their efforts towards a cure.

Thus we judge of the consequences of the small-pox, from the first appearance of the arm after inoculation; for if the beginning inflammation is small, pretty much circumscribed, and of the florid red with some rising, then we may in our own minds expect a good kind; the same upon the first appearance of the small-pox themselves; as also the first appearance of a chancre, etc. or almost of any other disease, either beginning with, or attended by inflammation; for it is by the kind of inflammation we are to judge of the future event.

It might be thought almost unnecessary here to treat of sound abscesses, because in such our first principles will readily take place, and often little or no assistance is required; but abscesses may be attended with circumstances which may retard the cure, and which have

nothing to do with unsoundness; such as extraneous bodies in sound parts, and these will most probably come under our general principles of cure; that is, require something to be done, because they will, in many cases, relieve themselves of the extraneous matter, and then they require but little assistance.

### I. *The Progress of Abscesses to the Skin.*

WHAT I mean by a sound abscess, is, where there is a sound constitution, the parts affected having all the disposition and powers to heal; those dispositions and powers allowed to take place, which will take place more readily if in structures of the body which have naturally a ready disposition to heal; so situated in the body as to be able to support its actions, and not of a specific kind, for which we have no cure; for any specific disease, for which we have a cure, will come within our first division.<sup>a</sup>

The inflammation in a sound and active part, and of a sound constitution, in general is pretty violent, attended from the very beginning with a considerable deal of pain,<sup>b</sup> suppura-

<sup>a</sup> Viz. If a venereal abscess has its specific quality destroyed, it admits of cure as readily as any other, and the same treatment becomes necessary.

<sup>b</sup> Vide Symptoms of Suppurative Inflammation.



tion takes place quickly; the parts between the abscess and the skin are readily affected, and ulceration goes on fast, the skin becomes of the florid red, the matter comes soon to it, especially at a point, and it bursts; all this is done with great rapidity.

These symptoms show such a degree of health in the constitution and the parts, that little is necessary for the surgeon to do in the first stages of the disease.

Poultices are recommended in such cases to assist that disposition which the parts have to give way between the skin and the abscess; but I have already observed, that they certainly can have no effect of this kind; however, they

This very appearance makes a material difference between an abscess arising from brisk inflammation, and one that is slow in its progress; it is so remarkable, that I have seen this effect where the matter was at such distance as not to be felt in the least, and where I have doubted whether there was matter or not, almost conceiving that it preceded suppuration. It certainly has this effect long before there is any distention: besides this, of a pointing taking place, there is another effect of deep suppurations in consequence of inflammation, which is an oedematous appearance, or thickening of the superficial parts. This was taken notice of by Le Dran, in internal abscess of the abdomen, where adhesions had taken place between the suppurating part and parietes of the abdomen, and by Mr. Pott, in suppuration of the brain; whether in such there is a pointing I do not know.

have their uses when the inflammation has reached the skin, for they keep it soft, allow the cuticle to distend, and give way to the swelling underneath; which eases the patient; warmth and moisture act in many cases as sedatives to our sensations, although not always; and the distinction between those where they give ease, and where they rather give pain, I have not been able to make out.

As an abscess of the healthy kind requires but little surgical treatment, between its commencement and opening, it also requires but very little attention afterwards for the cure, or the restoring the parts.

It depends on the operation of the powers, or abilities the machine is in possession of, more than any assistance the surgeon can give; however, abscesses may have other circumstances attending them, besides soundness and unsoundness, which will require surgical treatment; such as the extraction of exfoliated bones, which by their stay retard the cure. Further, as few inflammations arise in perfectly sound parts and constitutions, it will generally be necessary to treat them in some degree as if they had an unsound tendency, and also according to other circumstances; as no abscess can set about a cure till the matter is discharged, the first process, therefore, is the discharge of

the matter; but simply discharge is not always sufficient; therefore it becomes necessary to consider whether or not, almost in every case, it would not be proper to do more; and I am inclined to believe that whatever would in general assist an unsound abscess, would also do the same to a sound one; but this practice should be followed with great caution, and not carried too far; for in many it will be perfectly unnecessary, therefore it should not be practised; in others it will only be necessary in part; besides, in many cases it may do harm, for many abscesses may have tolerable dispositions under the present treatment, yet may be in such a state as very readily to fall into an unsound one, of some kind or other, when too much violence is committed; some having a tendency to irritability. On the other hand, our practice may fall short of the intention, as many parts have a strong tendency to indolence; and if the stimulating method is applied to the first it would be unlucky, and vice versâ.

It will be generally more in the power of the parts to perform a cure if certain operations are done, which even dispose the most active and healthy disposition, both of constitution and of parts to heal sooner; but this does not hold of the irritable. The first of these operations will be the mode of exposing abscesses, by

opening them sufficiently, which will make any particular treatment afterwards, either less necessary, or more easy of application, if necessary; so that the first principle of the cure, even of sound abscesses, may be the freedom of opening them in the beginning; however, the more sound they are, there is the less necessity for such treatment; for it does not give new powers to the parts, it keeps up those of which they are already in possession, and obliges them to go on towards a cure; for the living principle in parts seems uneasy under the circumstance of exposure, and of having no skin, more especially sound parts, therefore is roused to action, acting with a view to cover the part. It has no alternative; and as I have just now observed that few spontaneous abscesses take place from so slight a cause as simple violence produces, there must be a something to be got the better of. This is, perhaps, as well illustrated in the fistula in ano, as in any other; for without dividing along the gut to the bottom, which is where the disease is, and where the abscess formed, it seldom or never heals; however, all this will be according to circumstances, for if the suppuration is quick and comes fast to the skin, the parts will heal in the same proportion more readily, either with or without opening; therefore, in such instances, it is not



so necessary to open freely, though as it is not the method nature commonly takes, it has by many been objected to; but let us observe, that where an abscess opens of itself by a small orifice, the parts are commonly very sound where the opening is, although the bottom may be diseased; but if it be diseased where it opens, then ulceration commonly takes place at this orifice, which effects what should be done by art. To illustrate that a large opening is not detrimental to the healing of a sore, let us observe that there is no difference between an abscess opened largely, and a wound in consequence of an operation which is not healed by the first intention, such as an amputation, etc. for in such cases there is a breach in the continuity of the parts communicating with the skin, as large, if not larger, than at the bottom, and it heals readily; we endeavour, however, to remedy this as much as possible by saving skin, which, in some degree, answers to a small opening; and we may also observe, that where there is only a small opening leading to a large cavity, which is to suppurate, as in the case of an hydrocele treated by a caustic or seaton, (which, when come to suppuration, is in all respects similar to an abscess) that the whole, so far as suppuration extends, heals equally well with those that are wholly exposed; but I do

not know that they do better; and where the sack is not very sound, I do believe they do not do so well, as when more fully enlarged; and we may also observe, that opening largely in the scrotum is not subject to the same inconvenience as in many other parts, for here there is so much loose skin as to remove any retardment to the healing that might arise in other parts from opening largely; however, after viewing this in every light, there seems but little advantage gained in the one way or the other. The opening more or less freely must be directed by some other circumstance, by which the surgeon must be guided.

But as most abscesses owe some of their size to distention, and as this will be more or less according to circumstances, it becomes necessary to distinguish the one kind from the other, for the one will require a freer opening than the other.

Abscesses in soft parts will owe more of their size to distention than those in hard parts, such as bones, joints, etc.

Abscesses in soft parts, not connected with the hard, will owe more of their size to distention than those in soft parts connected with the hard; for instance, an abscess in the calf of the leg, thick of the thigh, buttock, etc. will owe more of its size to distention than an abscess on

the shin-bone, on the head, etc. Therefore an abscess, whose size is in some degree owing to distention, need not be so freely opened as one that is not; because, when the distention is taken off by the discharge of the pus, the parts will contract, or fall into their natural position, which cannot so easily happen in the other case. Besides, the granulations will also be allowed to contract in the one much more than the other. However, we find many abscesses healing very readily without any other opening than what was at first made by ulceration, and this will be more readily effected if the abscess has been allowed to break of itself; which I shall now more fully explain.

## II. *Of the Time when Abscesses should be opened.*

THE natural process that abscesses are obliged to go through for the discharge of their contents is in general the most proper, and it is so much so, as to be in most cases allowed to go on; and this process becomes more necessary in unsound abscesses than in sound ones, as it exposes them more fully, from ulceration having destroyed more of the parts between

the seat of the abscess and the external parts.

As abscesses, wherever formed, must increase as they approach the skin, and therefore increase that part of their cavity next to the skin, faster than at the bottom, so that they become in some degree tapering towards the bottom, with a wide part immediately under the skin, and this will be more or less so, according to its depth, its meeting with different substances, which give a resistance to the pus, or its coming fast or slowly to the skin.

This shape of the abscess, when allowed to take place, is well adapted for healing, for it puts the bottom, which is the seat of the disease, more upon a footing with the mouth of the abscess, than it otherwise could be. When these two are not well proportioned, there is a retardment in the cure; for as the bottom, or part where the abscess begun, is more or less in a diseased state, and as the parts between the seat of the abscess and the external surface are sound parts, having only allowed a passage for the pus, they of course have a stronger disposition to heal than the bottom has; and we commonly find this to be the case.

If there could be made at any time a difference in the powers of healing between the mouth of the abscess and its bottom, it ought



to be made the most defective at the mouth of the abscess, as that part is the easiest of management. To have this effect produced as much as possible, abscesses should be allowed to go on till they break or open of themselves; for although abscesses in general only open by a small orifice, more especially when sound, yet it is to be remarked, that the skin over the general cavity of the abscess is in such cases so much thinned as to have but very little disposition to heal, and is often so much so, as to ulcerate and make a free opening; and if it does not, an opening is more easily procured by art.

It is a curious circumstance in the œconomy of abscess, that those that have the best dispositions to heal come fastest to the skin; the lead takes place almost at a point, it does not swell so much into that conical form, above-described, not being under the same necessity in point of healing, and it opens by a small orifice; while, on the other hand, if there is an indolence in the progress of the abscess, it will spread more, or distend the surrounding parts from their not being so firmly united by inflammation in the one, as they were in the other; nor will ulceration so readily take the lead, and it will come to the skin by a broad surface, so as to thin a large portion of the skin. But abscesses should

only be allowed to open of themselves where the confinement of the matter can do no mischief, which will generally be in such as ought to heal up from the bottom: but in the reduction of circumscribed cavities to the state of an abscess, it will be in most cases proper to open early, as abscesses of the abdomen or thorax; those within the cranium; those of the eye; and those in joints.

In the abscess of the *tunica vaginalis testis* it would be better to let it open of itself, as it should be allowed to heal up from the bottom, similar to an abscess in the cellular membrane.

If it should be unnecessary to open freely, or if from circumstances this should be impossible, it will in either case be very proper to make the opening which is necessary or practicable at the most depending part, with a view to remove the pressure arising from the matter collected, which is commonly called confinement or lodgment of matter, which will otherwise happen; for I shall observe, that a very small pressure on that side of the abscess, next to the skin, may produce ulceration there; and although this pressure in many cases might not be so great as to produce ulceration at the bottom of the abscess, yet it may be so great as to prevent granulations from forming on that side,

and thereby retard the cure, as no union can take place but by means of granulations; or if it should not prevent granulations from forming, yet it might retard their growth, so that the cure would be more tedious, than if the pressure did not exist; and this retardation will be greatest where the pressure is the greatest, which will be at the most depending part of the abscess; so that its upper part will readily heal to a small point, and be reduced to the state of a fistula.

But it is not always possible to open at the most depending part of an abscess, and when possible, often very improper. When impossible, perhaps, nothing more can be done than to evacuate the matter as often as necessary, and by gentle pressure keep the sides of the sinus together, to allow their growing into one another; but the situation will not in all cases allow this.

The inexpediency of opening at the most depending part of an abscess will in general arise from the distance between the matter and the skin at this part, for if the abscess is pretty deeply seated, and points at a part superior to that of its seat, which it sometimes does from the parts above being such as more easily give way, in such a case it will be proper to open it where it points; for instance, if an abscess is

formed in the centre of the breast, and opens at the upper part, (which is often the case) it would be improper to cut through the lower half, to allow the matter to pass that way, although it may make its way there afterwards, from the pressure of the matter, as was just now observed; which I have seen happen more than once.

If an abscess forms on the upper part of the foot, it is improper to open through the sole of the foot to get at the most depending part of the abscess; for besides cutting such a depth of sound parts, which is an objection, it would be destroying a great many useful parts. It would also be impossible to keep it open, the sound parts having such a disposition to heal; and it would be contradictory to my first position, which was to have parts as thin as possible before they are opened, in order to destroy the healing disposition there.<sup>d</sup>

As in such cases, the place where the matter threatens to open a passage for itself, is where the future opening is most likely to be, and as the situation is disadvantageous to the healing of the seat of the abscess, it will be more necessary to let it first open of itself, because the abscess

<sup>d</sup> One would imagine that this last caution was hardly necessary; but I once saw a case where it was advised upon the general principles of opening in the most depending part.



just under the skin will be increased in width, as was observed, and then to dilate it as freely as may be thought necessary; for by allowing abscesses to open of themselves, the opening has a less disposition to heal than if it had been opened early by art, therefore is more desirable in such situations.

### III. *Of the Methods of opening Abscesses, and treating them afterwards.*

ALL abscesses, I have already observed, will open of themselves, excepting where the matter is re-absorbed; and I have also observed, that in general they ought to be allowed to open of themselves, excepting some particular circumstance calls for an early opening; but when the skin over the abscess is very thin, it is not of so much consequence whether it is allowed to open of itself, or is opened at first by art.

In large abscesses it will generally be necessary to open them by art, whether they have opened of themselves or not; for the natural opening will seldom be sufficient for the complete cure; and although it may be sufficient for the free discharge of the matter, yet they will heal much more readily if sufficiently opened; for the thin skin over the cavity gra-

nulates but indifferently, and therefore unites but slowly with the parts underneath. Where the skin is very thin, loose, and much of it, it may be necessary to remove an oval piece from the centre, where it is generally thinnest. A question naturally occurs, in what way should these be opened?

The methods recommended and used are by incision and caustic. Incision may or may not remove a piece of the skin, but the caustic always will. I believe, as a general practice, there is no preference to be given to either; but under circumstances, the incision is best; for instance, where there is but little skin to spare, as on the shin, scalp, etc. but where there is skin to spare, either arising from situation, as in the scrotum, or where a great deal of skin was thinned, as in a great extent of inflammation and suppuration under the skin, a caustic will answer equally well; therefore I should be very apt to be directed by my patients, if they had any fears or opinions about the matter; for some have a terror at the idea of a cutting instrument, while others hate the idea of a continued pain. If a caustic is approved of, then I should prefer the lapis infernalis, or scepticus, to the common caustic; the method of application I described, when speaking of the methods of producing death by art: but if left entirely

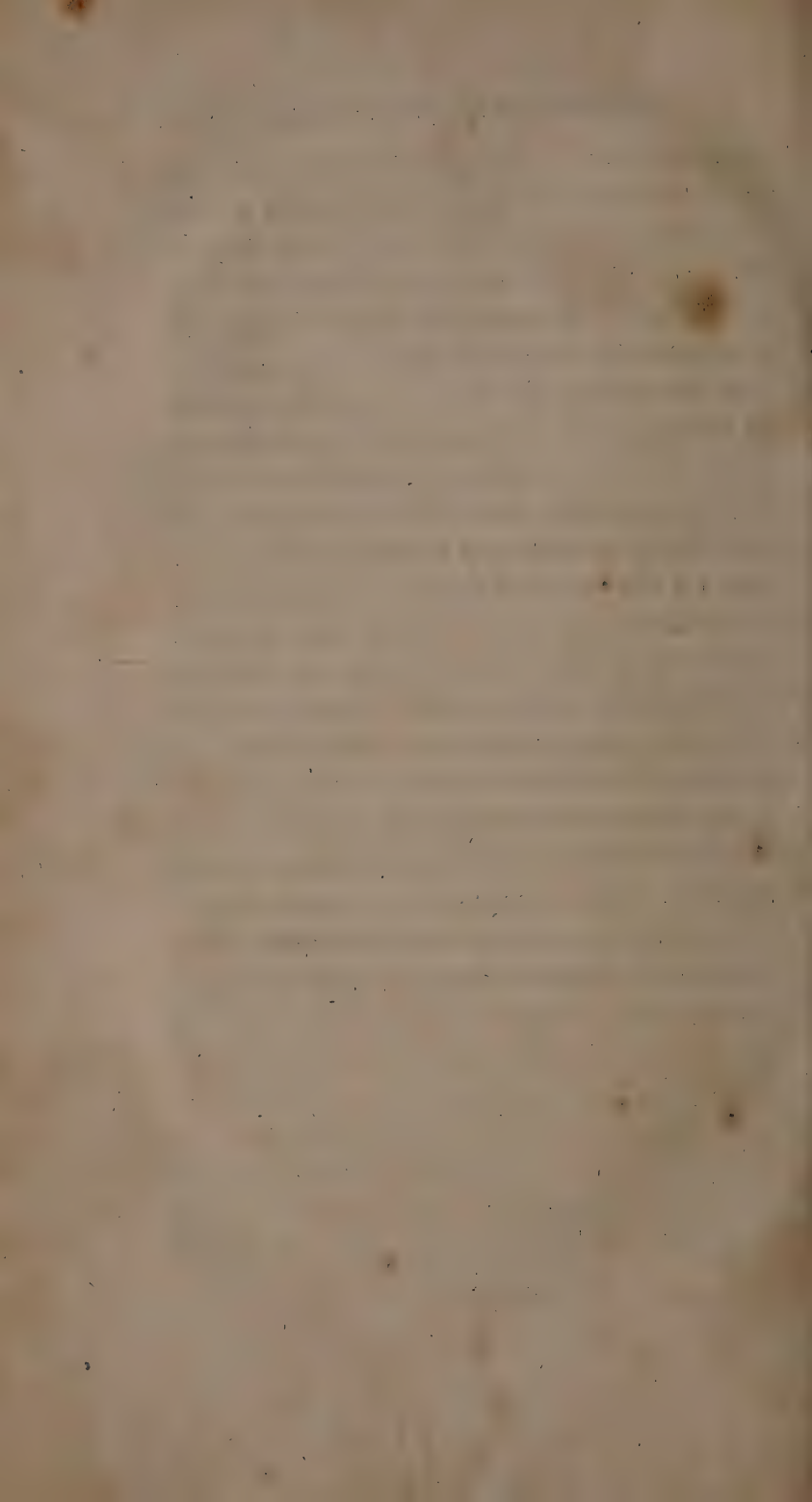
to myself, I should prefer the incision to the caustic, because it is immediately done.

If an abscess is allowed to open of itself, and this opening is not enlarged, no dressing is necessary, nor any thing but to keep the surrounding parts clean; the continuation of the poultice, which was before applied, (if convenient) is perhaps as good an application as any; and when the tenderness arising from inflammation is over, then lint and a pledget; but an abscess opened by a cutting instrument, may be called a mixed case, being both a wound and a sore, and is more of the nature of a fresh wound in proportion to the thickness of the parts cut; and therefore the dressing should be somewhat similar to that of a fresh wound. It is necessary that something should be put into the opening, to keep it from healing by the first intention; if it is lint, it should be dipt in some salve, which will answer better than lint alone, as it will allow of more early extraction; for such sores should be dressed the second time the next day, or the second day at latest; because there is a suppurating sore at the bottom, and the pus requires being discharged much sooner than if wholly either a fresh wound or a circumscribed cavity, which is to suppurate, as the tunica vaginalis in the case of the radical cure of the hydrocele. This pus

keeps the lint (if dressed with lint) moist, so that it does not dry, as in fresh wounds in common. When the cut edges have come to supuration, which will be in a few days, then the dressing afterwards may be as simple as possible, for nature will in general perform the cure.

If the abscess has been opened by caustic, and the slough is either cut out, or allowed to slough out, then it is to be considered as an entire suppurating sore, and may be dressed accordingly; perhaps dry lint is as good as any thing, till the nature of the sore is known; if of a good kind, the same dressing may be continued, but if not, then it must be dressed accordingly; for nature cannot always perform a cure; for parts which were at first sound, or appeared so, from their readiness to go through the first stages, will subsequently take on every species of disease, whether from indolence, from irritability, from scrofulous, or other dispositions, which in some cases are produced from the nature of the parts diseased, such as bone, ligament, etc.





## PART IV.

### CHAPTER I.

#### *OF GUN-SHOT WOUNDS.*

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GUN-SHOT wounds may be said to be an effect of a modern improvement in offence and defence, unknown in the former mode of war, which is still practised where European improvements are not known; and it is curious to observe that fire-arms and spirits are the first of our refinements that are adopted in uncivilized countries; and, indeed, for ages they have been the only objects that have been at all noticed or sought after by rude nations. It was not till the fourteenth century that gun-powder was made, or rather compounded; but it was not, till afterwards, applied to the purpose of projecting bodies. But even now, the wounds received in war are not all gun-shot wounds:

some, therefore, are similar in many respects to those received in former times.

The knowledge of the effect of gunpowder, and its application to the art of war, or the projection of bodies for the destruction of men, has been in some degree accompanied by improvements in the arts and sciences in general, and among others, that of surgery, in which art, the healing of wounds so produced, makes a material part. In France, more especially, the study of both were carried to considerable lengths; but though the art of destruction has been there improved and illustrated by writings, it is rather surprising that the art of healing should not have been equally illustrated in the same manner. Little has been written on this subject, although, perhaps, when we take every circumstance into consideration, it requires particular discussion; and what has been written is so superficial, that it deserves but little attention. Practice, not precept, seemed to be the guide of all who studied in this branch; and, if we observe the practice hitherto pursued, we shall find it very confined, being hardly reduced to the common rules of surgery, and therefore it was hardly necessary for a man to be a surgeon to practise in the army.

I. *The Difference between Gun-shot Wounds  
and common Wounds.*

GUN-SHOT wounds are named, as is evident, from the manner in which they are produced. From the frequency of their happening in the time of battle to a set of men appropriated for war, both by sea and land; and from the appointment of particular surgeons for their cure, they have been considered apart from other wounds, and are now become almost a distinct branch of surgery.

Gun-shot wounds are made by the projection of hard obtuse bodies, the greatest number of which are musket-balls; for cannon-balls, pieces of shells and stones from ramparts in sieges, or splinters of wood, etc. when on board of a ship in an engagement at sea, can hardly have their effects ranked among gun-shot wounds, they will come in more properly with wounds in general. As the wounds themselves made by those very different modes will in general differ very considerably, any peculiarity that may be necessary in the treatment of gun-shot wounds, from those made by cannon-balls, shells, etc. or even common wounds, will generally belong to those made by musket-balls.



The whole of gun-shot wounds will come within the definition of accidents. They are a recent violence committed on the body; but they often become the cause of, or degenerate into a thousand complaints, which are the objects of surgery or physic, many of which are common to accidents in general, and to many other diseases; of this kind are abscesses, ulcerating bones, fistulæ; but some are peculiar to gun-shot wounds, as calculi in the bladder, from the ball entering that viscus, consumption from wounds in the lungs, which I believe rarely happens; for I cannot say I ever saw a case where such an effect took place. But it is the recent state in which they are distinguished, and in which they are to be considered as a distinct object of treatment.

Wounds of this kind vary from one another, which will happen according to circumstances; these variations will be in general according to the kind of body projected, the velocity of the body, with the nature and peculiarities of the parts injured. The kind of body projected, I have observed, is principally musket-balls, sometimes cannon-balls, sometimes pieces of broken shells, and very often on board of ship, splinters of wood. Indeed the effects of cannon-balls on different parts of the ship, either the containing parts, as the hull of the ship itself,

or the contained, are the principal causes of wounds in the sailor; for a cannon ball must go through the timbers of the ship before it can do more execution than simply as a ball, (which makes it a spent ball) and which splinters the inside of the ship very considerably, and moves other bodies in the ship, neither of which it would do if moving with sufficient velocity; musket or cannon-balls seldom doing immediate injury to those of that profession. The wounds produced by the three last bodies will be more like many common and violent accidents, attended with much contusion and laceration of parts.

Gun-shot wounds, from whatever cause, whether from a musket-ball, cannon-ball, or shell, etc. are in general contused wounds, from which contusion there is most commonly a part of the solids surrounding the wound deadened, as the projecting body forced its way through these solids, which is afterwards thrown off in form of a slough, and which prevents such wounds from healing by the first intention, or by means of the adhesive inflammation, from which circumstance most of them must be allowed to suppurate. This does not always take place equally in every gun-shot wound, nor in every part of the same wound; and the difference commonly arises from the

variety in the velocity of the body projected; for we find in many cases, where the ball has passed with little velocity, which is often the case with balls, even at their entrance, but most commonly at the part last wounded by the ball, that the wounds are often healed by the first intention.

Gun-shot wounds, from the circumstance of commonly having a part killed, in general do not inflame so readily as those from other accidents; this backwardness to inflame will be in the proportion that the quantity of deadened parts bear to the extent of the wound; from which circumstance the inflammation is later in coming on, more especially when a ball passes through a fleshy part with great velocity; because there will be a great deal deadened, in proportion to the size of the wound; therefore inflammation in gun-shot wounds is less than in wounds in general, where the same quantity of mischief has been done; and this, also, is in an inverse proportion to the quantity of the parts deadened, as I have already explained in my introduction to inflammation, viz. that inflammation is less, where parts are to slough, than where parts have been destroyed by other means. On the other hand, where the ball has fractured some bone, which fracture in the bone has done considerable mischief to the soft parts, inde-

pendent of the ball, then there will be nearly as quick inflammation as in a compound fracture of the same bone, because the deadened part bears no proportion to the laceration or wound in general.

From this circumstance, of a part being often deadened, a gun-shot wound is often not completely understood at first; for it is at first, in many cases, impossible to know what parts are killed, whether bone, tendon, or soft part, till the deadened part has separated, which often makes it a much more complicated wound than at first was known or imagined; for it very often happens, that some viscus, or a part of some viscus, or a part of a large artery, or even a bone, has been killed by the blow, which does not show itself till the slough comes away. If, for instance, it is a part of an intestine that has received a contusion, so as to kill it, and which is to slough, a new symptom will most probably appear from the sloughs being separated, the contents of the intestine will most probably come through the wound; and probably the same thing will happen when any other containing viscus is in part deadened; but those cases will not be so dangerous, as if the same loss had been produced at first, for by this time all communication will be cut off between the containing and con-



tained parts; nor will it be so dangerous as when a considerable blood vessel is deadened; for in this case, when the slough comes off, the blood, getting a free passage into the wound, as also out of it, probably death will immediately follow. If this artery is internal, nothing can be done; if in an extremity, the vessel may be either taken up, or probably amputation may be necessary to save the person's life; therefore an early attention should be paid to accidents, where such an event is possible. In case of a bone being deadened, an exfoliation takes place.

Gun-shot wounds are often such as do much mischief to vital parts, the effects of which will be according to the nature of the parts wounded, and the violence of the wound; and also to parts, the soundness of which are essential either to the health of the whole, or to the uses of the parts wounded; such as some viscus, whose contents are voided through the opening, or joints, the disposition of which is slow to heal, and whose uses are impeded when healed.

Gun-shot wounds often admit of being classed with the small and deep-seated wounds, which are always of a particular kind respecting the cure.

The variety of circumstances attending gun-shot wounds is almost endless; the following case may be given as an example.

An officer in the navy was wounded by a pistol-ball, in the right side, about the last rib; it entered about five inches from the naval, and appeared on the inside of the skin about two inches from the spinal process, having passed, I believe, in among the abdominal muscles. The only remarkable thing that occurred was, that the cellular membrane for some way about the passage of the ball was oedematous, and when I cut out the ball, air come out with it.

## II. *Of the Different Effects arising from the Difference in the Velocity of the Ball.*

MANY of the varieties between one gun-shot wound and another, arise from the difference in the velocity of the body projected; and they are principally the following.

If the velocity of the ball is small, then the mischief is less in all of them; there is not so great a chance of their being compounded with fractures of the bones, etc. but if the velocity is sufficient to break the bone it hits, the bone will be much more splintered than if the velocity had been very considerable; for where the

velocity is very great, the ball, as it were, takes a piece out; however, all this will also vary according to the hardness of the bone. In a hard bone the splinters will be the most frequent.

When the velocity is small, the direction of the wound produced by the ball, will, in common, not be so straight, therefore its direction not so readily ascertained, arising from the easy turn of the ball.

When the velocity is small, the deadened part or slough is always less; for with a small velocity, a ball would seem only to divide parts, while when the velocity is great, the contrary must happen; from this circumstance it is, that the slough is larger at that orifice where the ball enters than where it comes out; and if the ball meets with a great deal of resistance in its passage through, there will very probably be no slough at all at its exit, which will be therefore only a lacerated wound.

The greater the velocity of the ball, the cleaner it wounds the parts, so much so as almost to be similar to a cut with a sharp instrument; from which circumstance it might be imagined, that there should be a smaller slough; but I suspect, that a certain velocity given to the best cutting instrument, would produce a slough on the cut edges of the divided parts;

for the divided parts not giving way equally to the velocity of the dividing body, must of course be proportionally bruised.

Gun-shot wounds are attended with less bleeding than most others; however, some will be attended with this symptom more than others, even in the same part; this arises from the manner in which the wound is produced: bleeding arises from a vessel being cut or broken; but the freedom of bleeding arises from the manner in which this is done: if the artery is cut directly across, and it is done by a ball passing with a considerable velocity, it will bleed pretty freely; if bruised, and in some degree torn, then it will bleed less. When the velocity of the ball is small, the vessels will be principally torn, for they will have time to stretch before the continuity of their parts gives way; but if it is great, they will bleed more freely, because velocity will make up for want of sharpness.

According to the velocity of the ball so is the direction. When the velocity is great, the direction of the ball will be in general more in a straight line than when it is small; for under such circumstances the ball more easily overcomes obstructions, and therefore passes on in its first direction.



Velocity in the ball makes parts less capable of healing, than when it moves with a small velocity; therefore gun-shot wounds in pretty thick parts are in general later of healing at the orifice where the ball enters, than at the orifice where it passes out; because it becomes in some degree a spent ball, the part having less slough, being only torn, which will often admit of being healed by the first intention.

In cases where the ball passes through, and in such a direction as to have one orifice more depending than the other, I have always found that the depending orifice healed soonest, and more certainly so if the ball came out that way, and also if the ball had been pretty much spent in its passage; therefore it will require art to keep the depending orifice open, if thought necessary; but this circumstance of its being a spent ball, will not always happen, because if the person is near the gun when fired, the velocity of the ball will be very little diminished in its progress through the soft parts; and therefore it will have nearly the same velocity on both sides.

This fact of the lower orifice healing soonest, is common to all wounds, and I believe is owing to the tumefaction which generally arises from the extravasated fluid always depending to the

lower part, and being retarded at the lower orifice, it is as it were stopped there, and presses the sides of the wound together, obliging it to heal, if the parts have not been deadened; this is evidently the case after the introduction of the seton in the hydrocele, especially if the two orifices of the seton are at some distance; but in the hydrocele there is a more striking reason for it; for in this disease, the extravasated fluids are wholly detained about the lower orifice, as there is no depending part for the fluid to descend to.

### III. *Of the Different kinds of Gun-shot Wounds.*

GUN-SHOT wounds may be divided into the simple, and the compound. Simple, when the ball passes into, or through the soft parts only: the compound will be according to the other parts wounded.

The first species of compound, are those attended with fractures of the bones, or with the wound of some large artery.

The second species of compound wounds is, where the ball penetrates into some of the larger circumscribed cavities. This last, or

penetrating wound, may be doubly complicated, or may be divided into two. First, simply penetrating; and, secondly, where some viscus or contained part, as the brain, lungs, heart, abdominal viscera, etc. is injured; all which cases will be taken notice of in their proper places.

## CHAPTER II.

*OF THE TREATMENT OF GUN-SHOT WOUNDS.*

IT has been hitherto recommended, and universally practised by almost every surgeon, to open immediately upon their being received, or as soon as possible, the external orifice of all gun-shot wounds made by musket-balls; so much has this practice been recommended, that they have made no discrimination between one gun-shot wound and another; this would appear to have arisen, and to be still continued, from an opinion that gun-shot wounds have a something peculiar to them, and of course are different from all other wounds, and that this peculiarity is removed by the opening; I own that I do not see any peculiarity. The most probable way of accounting for the first introduction of this practice, is from the wound in general being small, and nearly of a size from one end to the other; also the frequency of extraneous bodies being forced into these wounds by the ball, or the ball itself remaining there; for the way in which these wounds are made, is by the intro-



duction of an extraneous body which is left there, if it has not made its way through, so that the immediate cause of the wound makes a lodgment for itself; often carrying before it clothes, and even the parts of the body wounded, such as the skin, etc.: from hence it would naturally appear at first view, that there was an immediate necessity to search after those extraneous bodies, which very probably led the surgeon to do it; and in general the impossibility of finding them, and even of extracting them when found, without dilatation, gave the first idea of opening the mouths of the wounds; but, from experience, they altered this practice in part, and became not so desirous of searching after these extraneous bodies; for they found that it was oftener impossible to find them than could at first have been imagined, and when found, that it was not possible to extract them, and that afterwards these bodies were brought to the skin by the parts themselves, and those that could not be brought to the external surface in this way, were such as gave little or no trouble afterwards, such as balls; yet they altered this practice only so far as respected the attempt to extract extraneous bodies, for when they found from experience, that it was not necessary nor possible to extract these immediately, yet they did not see that it

therefore was not necessary to take the previous or leading steps towards it.

The circumstance I have mentioned, of gun-shot wounds being contused, obliges most of them to suppurate, because in such cases there is more or less of a slough to be thrown off, especially at the orifice made by the entrance of the ball; there is, therefore, a freer passage for the matter, or any other extraneous substance, than the same sized wound would have, if made by a clean cutting instrument, even if not allowed to heal by the first intention.

From all which, if there is no peculiarity in a gun-shot wound, I think this of dilating them as a general practice should be rejected at once, even were it only for this reason, that few gun-shot wounds are alike, and therefore the same practice cannot apply to all.

This treatment of gun-shot wounds is diametrically opposite to a principal which is generally adopted in other cases, although not understood as a general rule, which is, that very few wounds of any kind require surgical treatment at their commencement, excepting with an opposite view from the above, viz. to heal them by the first intention.

It is contrary to all the rules of surgery founded on our knowledge of the animal œco-

mony to enlarge wounds simply as wounds: no wound, let it be ever so small, should be made larger, excepting when preparatory to something else, which will imply a complicated wound, and which is to be treated accordingly; it should not be opened because it is a wound, but because there is something necessary to be done, which cannot be executed unless the wound is enlarged.

This is common surgery, and ought also to be military surgery respecting gun-shot wounds.

As a proof of the inutility of opening gun-shot wounds as a general practice, I shall mention the cases of four Frenchmen, and a British soldier, wounded on the day of the landing of our army on the island of Bellisle; and as this neglect rather arose from accident than design, there is no merit claimed from the mode of treatment.

Case I. A. B. was wounded in the thigh by two balls, one went quite through, the other lodged somewhere in the thigh, and was not found while he was under our care.

II. B. C. was shot through the chest; he spit blood for some little time.

III. C. D. was shot through the joint of the knee: the ball entered at the outer edge of

the patella, crossed the joint under that bone, and came out through the inner condyle of the os femoris.

IV. D. E. was shot in the arm: the ball entered at the inside of the insertion of the deltoid muscle, passed towards the head of the os humeris, then between the scapula and ribs, and lodged between the basis of the scapula and spinal processes, and was afterwards extracted. The man's arm was extended horizontally when the ball entered, which accounts for this direction.

These four men had not any thing done to their wounds for four days after receiving them, as they had hid themselves in a farm-house all that time after we had taken possession of the island; and when they were brought to the hospital, their wounds were only dressed superficially, and they all got well.

A grenadier of the 30th regiment was shot through the arm, the ball seemed to pass between the biceps muscle and the bone; he was taken prisoner by the French. The arm swelled considerably, they fomented it freely, and a superficial dressing only was applied. About a fortnight after the accident he made his escape, and came to our hospital; but by that time the swelling had quite subsided, and the wounds healed; there only remained a stiffness in the



joint of the elbow, which went off by moving it.

### I. *Of the Propriety of dilating Gun-shot Wounds.*

It would be absurd for any one to suppose that there is never occasion to dilate gun-shot wounds at all; but it is certain there are very few in which it is necessary. It will be impossible to determine by any general description what those are that ought to be opened, and what those are that ought not; that must be left in a great measure to the discretion of the surgeon, when once he is master of the arguments on both sides.

Some general rules may be given with regard to the more simple cases; but with regard to the more complicated, the particular circumstances of each case are the only guide; and they must be treated according to the general principles of surgery.

Let us first give an idea of the wound that would appear to receive no benefit from being dilated; and first of the most simple wounds.

If a ball passes through a fleshy part where it can hurt no bone in its way, such as the thick of the thigh, I own, in such a simple

wound, I see no reason for opening it; because I see no purpose that can be answered by it, except the shortening of the depth of the wound made by the ball, which can be productive of no benefit. If the ball does not pass through, and is not to be found, opening can be of as little service.

If the opening in the skin should be objected to, as being too small, and thereby forming an obstruction to the exit of the slough, etc. I think that in general it is not; for the skin is kept open by its own elasticity, as we see in all wounds; this elasticity, muscles and many other parts have not; and in general the opening made by a ball is much larger than those made by pointed instruments; for I have already observed, that there is often a piece of the skin carried in before the ball, especially if it passed with considerable velocity, besides the circular slough; so that there is really in such cases a greater loss of substance; therefore, whatever matter or extraneous body there is, when it comes to the skin, it will find a free passage out. Nor does the wound in the skin in general heal sooner than the bottom; and, indeed, in many cases not so soon, because the skin is generally the part that has suffered most.

However, this is not an absolute rule, for the skin sometimes heals first; but I have found

this to be the case as often where openings had been made, as in those where they had not; and this will depend upon circumstances or peculiarities; such as the bottom being at a considerable distance, with extraneous bodies, and having no disposition to heal, tending to a fistula; and I have observed in those cases, that the wound or opening made by the surgeon generally skinned to a small hole before the bottom of the wound was closed, which brings it to the state it would have been in, if it had not been dilated at all, expecially if there are extraneous bodies still remaining; for an extraneous body causes and keeps up the secretion of matter, or rather keeps up the disease at the bottom of the wound, by which means the healing disposition of its mouth is in some degree destroyed.

Let me state a case of this last description. Suppose a wound made with a ball; that wound (from circumstances) is not to heal in six months, because the extraneous bodies, etc. cannot be extracted, or work out sooner, or some other circumstance prevents the cure in a shorter time; open that wound as freely as may be thought necessary, I will engage that it will be in a month's time in the same state with a similar wound that has not been opened, so that the whole advantage (if there is any) must be

before it comes to this state; but it is very seldom that any thing of consequence can be done in that time, because the extraneous bodies do not come out at first so readily as they do at last, for the inflammation and tumefaction, which extends beyond that very opening, generally keeps them in; and if the wound is opened on their account at first, it ought to be continued to the very last. Upon the same principle, opening on account of extraneous bodies at first cannot be of so much service as opening some time after; for the suppuration, with its leading causes, viz. inflammation and sloughing, all along the passage of the ball, makes the passage itself much more determined and more easily followed; for the want of which, few extraneous bodies are ever extracted at the beginning, excepting what are superficial, small, and loose.

If the extraneous bodies are broken bones, it seldom happens that they are entirely detached, and therefore must loosen before they can come away; also the bones in many cases are rendered dead, either by the blow or by being exposed, which must exfoliate, and this requires some time; for in gun-shot wounds, where bones are either bruised or broke, there is most commonly an exfoliation, because some part of the bone is



deadened, similar to the slough in the soft parts.

A reason given for opening gun-shot wounds is, that it takes off the tension arising from the inflammation, and gives the part liberty; this would be very good practice if tension or inflammation were not a consequence of wounds; or it would be very good practice, if they could prove that the effects from dilating a part that was already wounded were very different, if not quite the reverse of those of the first wound; but as this must always be considered as an extension of the first mischief, we must suppose it to produce an increase of the effects arising from that mischief; therefore this practice is contradictory to common sense and common observation.

They are principally the compound wounds that require surgical operations, and certain precautions are necessary with regard to them, which I shall here lay down.

As the dilatation of gun-shot wounds is a violence, it will be necessary to consider well what relief can be given to the parts or patient by such an operation; and whether without it more mischief would ensue; it should also be considered what is the proper time for dilating.

But it will be almost impossible to state what wound ought, and what wound ought not be opened; this must always be determined by the surgeon, after he is acquainted with the true state of the case and the general principles; but from what has been already said, we may in some measure judge what those wounds are that should be opened, in order to produce either immediate relief, or to assist in the cure: we must have some other views than those objected to, we must see plainly something to be done for the relief of the patient by this opening, which cannot be procured without it, and if not procured, that the part cannot heal, or that the patient most probably must lose his life.

The practice to be recommended here will be exactly similar to the common practice of surgery, without paying any attention to the cause as a gun-shot wound.

One of the principal points of practice will be to determine at what period of time the dilatation should be made.

First, if the wound should be a slight one, and should require opening, it will be better to do it at the beginning, before inflammation comes on; for the inflammation, in consequence of both, will be slight; but in slight cases dilatation will never be necessary, except to allow

of the extraction of some extraneous body that is near. But if the wound is a considerable one, and it should appear upon consideration, that you cannot relieve immediately any particular part, or the constitution, then you can gain nothing by opening immediately, but will only increase the inflammation, and in some cases the inflammation arising from the accident and opening together, may be too much for the patient; under this last circumstance, it would be more advisable to wait till the first inflammation ceases, by which means the patient will stand a much better chance of a cure, if not of his life; therefore it is much better to divide the inflammations; however, it is possible that the inflammation may arise from some circumstance in the wound, which could be removed by opening it; for instance, a ball, or broken bone pressing upon some part whose actions are either essential to the life of the part or the whole, as some large artery, nerve, or vital part; in such the case will determine for itself.

On the other hand, it may in many cases be better to remove the whole by an operation, when in such parts as will admit of it, which will be taken notice of.

Secondly, if an artery is wounded, where the patient is likely to become either too weak, or to lose his life from the loss of blood; then,

certainly the vessel is to be tied, and most probably this cannot be done without previously opening the external parts, and often freely.

Or thirdly, in a wound of the head, where there is reason to suspect a fracture of the skull, it is necessary to open the scalp, as in any other common injury done to the head where there was reason to suspect a fracture, and when opened, if a fracture is found, it is to be treated as any other fractured skull.

Fourthly, where there are fractured bones in any part of the body that can be immediately extracted with advantage, and which would do much mischief if left, this becomes a compound fracture wherever it is, and it makes no difference in the treatment, whether the wound in the skin was made by a ball, or the bone itself, at least where the compound fracture is allowed to suppurate; for there is often a possibility of treating a compound fracture as a simple one, which gun-shot fractures, if I may be allowed the expression, seldom will allow of; but where the compound fracture must suppurate, there they are very similar. However, there have been instances where a fracture of the thigh-bone made by a ball has healed in the same way as a compound simple fracture.

Fifthly, where there is some extraneous



body which can with very little trouble be extracted, and where the mischief by delay will probably be greater than that arising from the dilatation.

Sixthly, where some internal part is misplaced, which can be replaced immediately in its former position, such as in wounds in the belly, where some of the viscera are protruded, and it becomes necessary to perform the operation of gastroraphia, which is to be done in this case in the same manner as if the accident arose from any other cause; but the treatment should be different; for gun-shot cases cannot heal by the first intention, on account of the slough that is to ensue.

Or, seventhly, when some vital part is pressed, so that its functions are lost or much impaired, such as will often happen from fractures of the scull, fractures of the ribs, sternum, etc. in short, when any thing can be done to the part after the opening is made for the present relief of the patient, or the future good arising from it. If none of these circumstances has happened, then I think we should be very quiet. Balls that enter any of the larger cavities, such as the abdomen or thorax, need not have their wounds dilated, except something else is necessary to be done to the contained

parts, for it is impossible to follow the ball; therefore they are commonly not opened, and yet we find them do very well.

Balls that enter any part where they cannot be followed, such as into the bones of the face, need not have the wound in the skin in the least enlarged, as it can give no assistance to the other part of the wound, which is a bony canal. The following cases are strongly in proof of this, being respectively instances of both modes of practice.

#### CASE FIRST.

I was sent for to an officer who was wounded in the cheek by a ball, and who had all the symptoms of an injured brain; upon examining the parts, I found that the ball had passed directly backwards through the cheek-bone; therefore, from the symptoms and from the direction of the wound, I suspected that the ball had gone through the basis of the scull into the brain, or at least had produced a depression of the scull there: I enlarged the external wound, and with my fingers could feel the coronoid process of the lower jaw; I found that the ball had not entered the scull, but had struck against it about the temporal process of the sphenoid bone, which it had broke, and afterwards passed down on the inside of the lower

jaw. With small forceps I extracted all I could of the loose pieces of bone; he soon recovered from his stupor, and also from his wound. The ball afterwards caused an inflammation at the angle of the lower jaw, and was extracted. The good which I proposed by opening and searching for extraneous bodies and loose pieces of bone was the relieving of the brain; but as the ball had not entered the scull, and as none of the bones had been driven into the brain, it is most probable that I did no good by my opening; but that I could not foresee.

#### CASE SECOND.

An officer received a wound by a ball in the cheek, (which in this case was on the opposite side:) the wound led backwards, as in the other; by putting my finger into the wound I felt the coronoid process of the lower jaw, as in the former; but he had no symptoms of an injured brain; I therefore advised not to open it, because the reason for opening in the preceding case did not exist here; my advice was complied with, and the wound did well, and rather better than the former, by healing sooner. The ball was never found, so far as I know.

The present practice is not to regard the balls themselves, and seldom or ever to dilate upon their account, nor even to search much

after them when the wound is dilated, which shews that opening is not necessary, or at least not made upon account of extraneous bodies.

This practice has arisen from experience; for it was found that balls, when obliged to be left, seldom or ever did any harm when at rest, and when not in a vital part; for balls have been known to lie in the body for years, and are often never found at all, and yet the person has found no inconvenience.

This knowledge of the want of power in balls to promote inflammation when left in the body, arose from the difficulty of finding them, or extracting them when found; and therefore in many cases they were obliged to leave them.

One reason for not readily finding the ball at first is, because the parts are only torn and divided, without any loss of substance, (till the slough comes off) by which means the parts collapse and fall into their places again, which makes it difficult to pass any thing in the direction of the ball, or even to know its direction. The different courses they take, by being turned aside by some resisting body, add also to the difficulty; as will be explained.

But the course of a ball, if not perpendicular, but passing obliquely, and not very deep, a little



way under the skin, probably an inch or more, is easy to be traced through its whole course, for the skin over the whole passage of the ball generally is marked by a reddish line. I have seen this redness, even when the ball has gone pretty deep; it has none of the appearances of inflammation, nor of extravasation, for extravasation is of a darker colour, and what it is owing to, I have not been able to discover. I can conceive it to be something similar to a blush; only the small vessels allowing the red particles of the blood to flow more easily.

## II. *Of the Strange Course of some Balls.*

THE difficulty of finding balls, I have just observed, often arises from the irregular course they take. The regularity of the passage of a ball will in general be in proportion to its velocity, and want of resistance; for balls are turned aside in an inverse proportion to the force that they come with; and this is the reason why we seldom find them take a straight course; for if they are spent balls, the soft parts alone are capable of turning them; and if they come with a considerable velocity, it is a chance they may hit some bone obliquely, and then

they are also turned aside, for any body that gives a ball the least oblique resistance, throws it out of its direct course; therefore, the balls that do not pass through and through (which are the only ones that are searched after) will be in general spent ones, excepting those that come directly against some considerable bone, as the thigh-bone, etc. As a proof that balls are easily thrown off obliquely, we often find that a ball shall enter the skin of the breast obliquely, and afterwards shall pass almost round the whole body under the skin. The skin here is strong enough to stop the balls coming out again, so that it turns it inwards, which meeting with the ribs, it is again turned out against the skin, and so on, alternately, as long as it has force to go on; however, in many cases, the ball goes a little way after it has passed through the skin, and when it meets with any hard body on that side next the centre of the body, such as a rib, its course is directed outwards, and it pierces the skin a second time; but the velocity of such balls must have been considerable.

I have seen a ball pass in at one side of the shin-bone, and run across it under the skin, without either cutting the skin across, or hurting the bone; which shows that the velocity could not be great; for we know that there is

not sufficient room between these two parts in a natural state for a ball to pass; but the ball, after it had got under the skin, where there was room for it to cover itself, then came against the tibia, which threw it outwards, and the skin counteracting, it only raised the skin from the tibia, and passed on between them; but if this ball had had a sufficient velocity, it would have either cut the skin across, or taken a piece out of the bone, or most probably both.

Another circumstance in favour of the uncertainty of their direction is, that the parts wounded are often not in the same position that they were when they received the ball. The French soldier who was wounded in the arm, was a striking instance of this. The ball entered the arm about its middle, on the inside of the biceps muscle, and it was extracted from between the two scapulæ, close on one side of the spinal process of the back-bone. The reason of this strange course, I have already observed in the case, was owing to his having had his arm stretched out horizontally at the time he was wounded, and the ball passed on in a straight line.

These uncertainties in the direction of the balls abovementioned, have made the common bullet-forceps almost useless; yet forceps are not to be entirely thrown aside, for it will often

happen, that a ball will be found to lie pretty near the external wound, which, if the ball was removed, would heal, probably, by the first intention; for in such superficial wounds they must have passed with little velocity; or if there was a part killed, it would heal immediately; but if there is a slough, this is best done after all inflammation, and the separation of the slough is over, for then the passage of the ball is better ascertained, in consequence of the surrounding adhesive inflammation; and, moreover, the granulations are beginning to push the extraneous body towards the surface; but the operation of ulceration, which brings it to the skin, being often too slow, the ball, etc. had better be extracted, and even the part might be dilated. However, I would be very cautious how far I carried this practice, and only do it when all circumstances favoured.

For the same reason probes are become of little use; indeed, I think that they should never be used but by way of satisfaction, in knowing sometimes what mischief is done; we can perhaps feel if a bone is touched, or if a ball is near, etc. but when all this is known, it is an hundred to one if we can vary our practice in consequence of it. If the wound will admit of it, the finger is the best instrument.

In cases where the ball passes a considerable



way under the skin, and near to it, I think it would be advisable to make an opening midway between the two orifices which were made by the ball (especially when the orifices are at a very great distance) that fractured bones, or extraneous bodies may now, or hereafter be better extracted; for if this is not done, we have often an abscess forming between them; which, indeed, answers the same purpose, and often better; but sometimes it should not be delayed for such an event to take place.

Where the ball has passed immediately under the skin, as in the case where the ball passed between the skin and tibia, it will be often proper to open the whole length of the passage of the ball, the necessity of which I think arises from the skin not so readily uniting with the parts underneath, as muscles do with one another.

Although we have given up in a great measure the practice of searching after the ball, broken bones, or any other extraneous bodies, yet it often happens that a ball shall pass on till it comes in contact with the skin of some other part, and where it can be readily felt; the question is, should such a ball be cut out? if the skin is bruised by the ball coming against it, so that we may imagine that this part will

slough off, in that case, I see nothing to hinder opening it, because the part is dead; therefore no more inflammation can arise from the opening than otherwise would take place upon allowing the slough to be thrown off; while, on the other hand, I should also suppose as little good to arise from it, because the ball will come out of itself when the part sloughs off; however, it may be suspected that before the slough falls off, the ball may so alter its situation, that it will be impossible to extract it by that opening; however, I should very much suspect the ball altering its course under such circumstances, for if the skin was so much bruised as to slough, inflammation would soon come on, and confine the ball to that place; however, it always gives comfort to the patient to have the ball extracted. But if the ball is only to be felt, and the skin quite sound, I would in that case advise letting it alone, till the wound made by the entrance of the ball had inflamed and was suppurating: my reasons for it are these:

First, we find that most wounds get well when the ball is left in (excepting it has done other mischief than simply passing through the soft parts) and that very little inflammation attends the wound where the ball lodges, only that where it enters the inflammation not

arising so much from the injury done by the ball, as from the parts being there exposed to the suppurative inflammation, if it is immediately removed. There is always a greater chance of a slough where the ball enters than where it rests, arising from the greater velocity of the ball; for, beyond where the slough is, the parts unite by the first intention.

Secondly, in those cases where the ball passes through and through, we have two inflammations, one at each orifice, instead of the one at the entrance; or a continued inflammation through and through, if the ball has passed with great velocity. Where the ball makes its exit, the inflammation passes further along the passage of the ball, than when the wound has been healed up to the ball, and then cut out afterwards; so that by opening immediately, the irritation will be extended further, and of course the disposition for healing will be prevented.

If this is the case, I think that two wounds should not be made at the same time; and what convinces me more of it is, that I have seen cases where the balls were not found at first, nor even till after the patients had got well of their wounds; and these balls were found very near the skin. They gave no trouble (or else they would have been found

sooner); no inflammation came upon the parts, and they were afterwards extracted and did well.

Again, I have seen cases where the balls were found at first, and cut out immediately, which were similar to balls passing through and through; the same inflammation came on the cut wounds, that came on the wounds made by the entrance of the ball.

### III. *Penetrating Wounds of the Abdomen.*

WOUNDS leading into the different cavities of the body are very common in the army, and in a great measure peculiar to war; they are mostly gun-shot wounds, but not always; some being made with sharp-pointed weapons, as swords, bayonets, etc. they are pretty similar in whatever way they are made; and I have given them a name expressive of the nature of the wound. I shall not take notice of any of this kind, but those which penetrate into the larger cavities, as the abdomen, thorax, and scull; but those into the scull are made most commonly by balls, shells, etc.

These wounds become more or less dangerous, according to the mischief done to



the contents of the cavity into which they penetrate.

These wounds may be distinguished according as they are simply penetrating, without extending to the contained parts, or, as they affect these parts; and the event of these two kinds of wounds is very different; for in the first, little danger is to be expected, if properly treated; but in the second, the success will be very uncertain; for very often nothing can be done for the patient under such wounds, and very often a good deal of art can be made use of with advantage.

Wounds of the parietes of the abdomen, not immediately inflicted on such a viscus as has the power of containing other matter, will in general do well, let the instrument that made the wound be what it will.<sup>a</sup> There will be a great difference, however, should that instrument be a ball passing with great velocity, for in this case a slough will be produced. But if it should pass with little velocity, then there will be less sloughing, and the parts will in some degree heal by the first intention, similar to those made by a cutting instrument; but although the ball has passed with such velocity

<sup>a</sup> What I mean by a containing viscus, is a viscus that contains some foreign matter, as the stomach, bladder, ureters, gall-bladder, etc. to which I may add blood-vessels.

as to produce a slough, yet that wound shall do well, for the adhesive inflammation will take place on the peritonæum all round the wound, which will exclude the general cavity from taking part in the inflammation, although the ball has not only penetrated, but has wounded parts which are not immediately essential to life, such as the epiploon, mesentery, etc. and perhaps gone quite through the body; yet it is to be observed, that wherever there is a wound, and whatever solid viscus may be penetrated, the surfaces in contact, surrounding every orifice, will unite by the adhesive inflammation, so as to exclude entirely the general cavity, by which means there is one continued canal wherever the ball or instrument has passed; or if any extraneous body should have been carried in, such as clothes, etc. they will also be included in these adhesions, and both these and the slough will be conducted to the external surface by either orifice.

All wounds that enter the belly, which have injured some viscus, are to be treated according to the nature of the wounded part, with its complications; which will be many, because the belly contains more parts of very dissimilar uses than any other cavity in the body; each of which will produce symptoms peculiar to itself, and the nature of the wound.

The wounding of the several viscera will often produce what may be called immediate and secondary symptoms, which will be peculiar to themselves, besides what are common to simple wounds, such as bleeding, which is immediate; and inflammation and suppuration, which are secondary. Sensations alone will often lead to the viscus wounded, and this is frequently one of the first symptoms.

The immediate symptoms arising from wounds in the different viscera are as follows:

From a wound in the liver there will be pain in the part, of the sickly or depressing kind; and if it is in the right lobe, there will be a delusive pain in the right shoulder, or in the left shoulder, from a wound in the left lobe.

A wound in the stomach will produce great sickness and vomiting of blood, and sometimes a delirium; a case of which I once saw in a soldier in Portugal, who was stabbed into the stomach with a stiletto by a Portuguese.

Blood in the stools will arise from a wound in the intestines, and, according to the intestine wounded, it will be more or less pure; if the blood is from a high part of an intestine it will be mixed with fœces, and of a dark colour; if low, as the colon, the blood will be less mixed, and give the tinge of blood; and the pain or sensation will be more or less acute, according

to the intestine wounded: more of the sickly pain, the higher the intestine, and more acute the lower. There will be bloody urine from a wound in the kidnies or bladder; and if made by shot or ball, and a lodgment made, these bodies will sometimes become the cause of a stone. The sensation will be trifling.

A wound of the spleen will produce no symptoms that I know of, excepting, probably, sickness, from its connexion with the nerves belonging to the stomach, etc.

Extravasations of blood into the cavity of the abdomen will take place, more or less, in all penetrating wounds, and more especially if some viscus is wounded, as they are all extremely vascular; and this will prove dangerous, or not, according to the quantity.

These are the immediate and general symptoms upon such parts being wounded; but other symptoms may arise in consequence of some of those viscera being wounded, which require particular attention. There may be wounds of the liver and spleen, which produce no symptoms but what are immediate, and may soon take on the healing disposition; but wounds in those viscera which contain extraneous matter, such as the stomach, intestines, kidnies, ureters, and bladder, may produce secondary symptoms of a distinctive kind. If the injury is done by



a ball to any of those viscera, the effect may be of two kinds; one where it makes a wound, as stated above, the other where it only produces death in a part of any of them; these will produce very different effects. The first will most probably be always dangerous; the second will hardly ever be so. The first is, where the ball has wounded some one of the abovementioned viscera in such a manner as not to produce the symptoms already described, but produce one common to them all, viz. their contents or extraneous matter immediately escaping into the cavity of the abdomen. Such cases will seldom or ever do well, as their effect will hinder the abovementioned adhesions taking place. The consequence of this will be, that universal inflammation on the peritonæum will take place, attended with great pain, tension, and death. But all this will be in proportion to the quantity of wound in the part, and quantity of contents capable of escaping into the cavity of the abdomen; for if the wound is small, and the bowels not full, then adhesions may take place all round the wound, which will confine the contained matter, and make it go on in its right channel. These adhesions may take place very early, as the following case shews.

The case of an officer who died of a wound which he received in a duel.

On Thursday morning, the 4th of September, 1783, about seven o'clock, an officer fought a duel in the Ring in Hyde-park, in which he exchanged three shot with his antagonist, whose last shot struck him on the right side, just below the last rib, and appeared under the skin on the opposite side, exactly in the corresponding place, and was immediately cut out by Mr. Grant.

About three hours after receiving this wound, I saw him with Mr. Grant. He was pretty quiet, not in much pain, rather low, pulse not quick, nor full, and a sleepy languidness in the eye, which made me suspect something more than a common wound. He then had had neither a stool nor made water, therefore it could not be said what viscera might be wounded. His belly had been fomented, a clyster of warm water was ordered, and a draught with confec: card: as a cordial, with twenty drops of laudanum, to procure sleep, as he wished to have some. We saw him again at three o'clock; the draught had come up. Had no stool from the clyster, nor any sleep; had made water, and no blood being found in it, we conjectured that the kidnies, etc. were not hurt. He was now rather lower, pulse smaller, more restless, a good deal of tension in the belly, which made him uneasy, and made

him wish to have a stool. It was at first imagined that this tension might be owing to extravasated blood; but on patting the belly, especially along the course of the transverse arch of the colon, it plainly gave the sound and vibration of air, therefore we wished to procure a motion, to see if we could not by that means have some of that air expelled; we wished, also, to repeat the cordial and the opium, but the stomach was become now too irritable to contain any thing, and was at times vomiting, independent of any thing he took; a clyster was given, but nothing returned or came away. We saw him again at nine o'clock in the evening. His pulse was now low and more frequent; coldness at times; vomiting very frequent, which appeared to be chiefly bile, with small bits of something that were of some consistence; the belly very tense, which made him extremely uneasy; no stool. From nothing passing downwards, and the colon continuing to fill, we began to suspect that it was becoming paralytic, probably, from the ball having divided some of its nerves.

Fumes of tobacco by clyster were proposed, but we were loath to use it too hastily, as it would tend to increase the disease, if it did not relieve; however, we were prepared for it.

Mr. Grant stayed with him the whole night;

all the above symptoms continued increasing, and about seven o'clock in the morning he died, viz. about twenty four hours after receiving the wound.

He was opened next day at ten o'clock, twenty-seven hours after death, when we found the body considerably putrid, although the weather was cold for the season, the blood having transuded all over the face, neck, shoulders and breast, with a bloody fluid coming out of his mouth, with an offensive smell; below this the body was not so far gone.

On opening the abdomen, a good deal of putrid air rushed out; then we observed a good deal of fluid blood, principally on each side of the abdomen, with some coagulum upon the intestines; when sponged up it might be about a quart.

The small intestines were slightly inflamed in many places, and there adhered. We immediately searched for the passage of the ball.

On searching for the course of the ball, we found that it had passed directly in, pierced the peritonæum, entered again the peritonæum, where it attaches the colon to the loins, passed behind the ascending colon, and just appeared at the right side of the root of the mesentery where the colon is attached; passed behind the



root of the mesentary, and entered the lower turn of the duodenum as it crosses the spine; then passed out of that gut on the left of the mesentery, and in its course to the left side, it went through the jejunum, about a foot from its beginning, then through between two folds of the lower part of the jejunum, taking a piece out of each, then passed before the descending part of the colon, and pierced the peritonæum of the left side, as also some of the muscles, but not the skin, and was immediately cut out, exactly in the same place on the left, where it entered out the right; so it must have passed perfectly in an horizontal direction.

There was no appearance of extravasation of any of the contents of the intestines loose in the cavity of the abdomen. The intestines in many places were adhering to one another, especially near to the wounds, which adhesions were recent, and of course very slight; yet they shewed a ready disposition for union, to prevent the secondary symptoms, or what may be called the consequent, which would also prove fatal.

There was little or no fluid in the small intestines; but there was a good deal of substance, in consistence like fœces, in broken pieces, about the size of a nut, through the whole track of the intestine, even in the stomach, which he vomited up; but in the upper end of the jeju-

num, as also in the duodenum, there was some fluid mixed with the other; but that fluid seemed to be rather bile. If this solid part was excrement then the valve of the colon must not have done its duty. Was all the thin part absorbed to hinder extravasation into the belly? or was it all brought back into the stomach to be vomited up? There was a good deal of air in the ascending, but more especially in the transverse turn of the colon.

This case admits of several observations and queries.

First, the lowness and gradual sinking, with the vomiting without blood, bespoke wounded intestines, and those pretty high up. It shews how ready nature is to secure all unnatural passages, according to the necessity.

Query, what could be the cause of his having no stool, even from the clyster? Were the intestines inclinable to be quiet under such circumstances? Would not he have lived if the immediate mischief had not been too much? I think that if the immediate cause of death had not been so violent, nature would have secured the parts from the secondary, viz. the extravasation of the fœces.

What is the best practice where it is supposed an intestine may be wounded? I should suppose the very best practice would be, to be

quiet and do nothing, except bleeding, which in cases of wounded intestines is seldom necessary.

As he was extremely thirsty, and could not retain any thing in his stomach, which if he could, it would have been probably productive of mischief, by giving a greater chance of extravasation; would not the tepid bath have been of service, to have allowed of fluids to enter the constitution?

It is very possible that a wound of the gall-bladder, but more readily of the ductus communis, and also of the pancreatic duct, will produce the same effects, although not so quickly; and it may be observed, that a wound in them could not be benefited by any adhesions that could take place, because the secreted fluids could never, most probably, get into the right channel again, and would therefore be the cause of keeping the external wound open, to discharge the contents, as we find to be the case in the disease, called fistula lachrymalis; as also when the duct of the parotid gland is divided.

Of parts that have been only deadened.

Wounds will be very similar to the above-stated penetrating wounds, but they will differ from them in effects, arising from a slough separating from a containing viscus; for whenever the slough comes away, the extraneous or

contained matter of that viscus will escape by the wound; such as the contents of the stomach, intestines, ureters, bladder, etc. the two last of which will be similar, or the slough may escape by either of these outlets; whereas, in the last kind of wounds, any of the contents that could possibly escape would immediately pass into the cavity of the abdomen.

The periods of these symptoms appearing after the accident, will be according to the time of separation; which may be in eight, ten, twelve, or fourteen days.

This new symptom, although in general very disagreeable, will not be dangerous,<sup>b</sup> for all the danger is over before it can appear; but that the orifice should afterwards continue, and become either an artificial anus, or urethra, is a thing to be avoided; though they commonly close up, and the contents are directed the right way; in such case, nothing is to be done, but dressing the wound superficially, and when the contents of the wounded viscus becomes less, we may hope for a cure.

The following case explains the foregoing remarks.

<sup>b</sup> How far the contents of the stomach escaping through a wound might not be attended with bad consequences, I cannot pretend to say.



A young gentleman was shot through the body. The musket was loaded with three balls, but there were only two orifices where they entered, and also only two where they came out, one of the balls having followed one of the others; that there were three that went through him was evident, for they afterwards made three holes in the wainscot behind him, but two very near one another.

The balls entered upon the left side of the navel, one a little further out than the other, and they came out behind, pretty near the spinal processes, about the superior vertebræ of the loins. From the closeness of the gun to the man when fired, which of course made it pass with great velocity, as also from the direction of the innermost, which we supposed to be the double one, we were pretty certain that it had penetrated the cavity of the abdomen, but could not be so certain of the course of the other.

The first water he made after the accident was bloody, from which we knew the kidney was wounded; but that symptom soon left him. He had no blood in his stools, from which we concluded that none of the intestines were wounded; and no symptoms of extravasation of the contents of any viscus taking place, such as the symptoms of inflammation of the peri-

tonæum, we were still more confirmed in our opinion.

The symptomatic fever did not run higher than could have been expected; nor was there more pain in the track of the ball than might be imagined.

These consequent symptoms of the immediate injury abated as soon as could be expected; and in less than a fortnight, I pronounced him out of danger from the wound; for no immediate secondary symptoms having taken place, I concluded that whatever cavities the balls had entered, there the surrounding parts had adhered, so that the passage of the ball was by this means become a complete canal; and therefore that neither any extraneous bodies that had been carried in with the balls, and had not been carried through, nor any slough that might separate from the sides of the canal, nor the matter formed in it, could now get into the cavity of the abdomen, but must be conducted to the external surface of the body, either through the wounds, or from an abscess forming for itself, which would work its own exit somewhere.

But this conclusion was supposed to be too hasty, and soon after a new symptom arose, which alarmed those who did not see the propriety of my reasoning; which was some fœces

coming through the wound; this new symptom did not alter my opinion, respecting the whole operations of nature to secure the cavity of the abdomen, but it confirmed it, (if a further confirmation had been necessary) and therefore I conceived it could not affect life; but as I saw the possibility of this wound becoming an artificial anus, I was sorry for it. It was not difficult to account for the cause of this new symptom; it was plain that an intestine, (the descending part of the colon most probably) had only received a bruise from the ball, but sufficient to kill it at this part, and till the separation of the slough had taken place, that both the intestine and canal were still complete, and therefore did not communicate with each other; but when the slough was thrown off, the two were laid into one at this part, therefore the contents of the intestine got into the wound, and the matter from the wound might have got into the intestine. However, this symptom gradually decreased, by (we may suppose) the gradual contraction of this opening, and an entire stop to the course of the fœces took place, and the wounds healed very kindly up.

But the inflammation, the sympathetic fever, the reducing treatment, and the spare regimen, all tended to weaken him very much.

#### IV. *Of penetrating Wounds in the Chest.*

LITTLE notice has been taken of wounds in the chest and lungs; indeed it would appear at first, that little or nothing could be done; yet, in many cases a great deal may be done for the good of the patient.

It is possible a wound in the chest may be of the first kind, viz. only penetrating; yet from circumstances may prove fatal, as will be explained in the second or complicated, viz. a wound of the lungs.

It is pretty well known, that wounds of the lungs (abstracted from other mischief) are not mortal. I have seen several cases where the patient has got well after being shot quite through the body and lungs, while from a very small wound made by a sword or bayonet into the lungs, the patients have died; from which I should readily suppose, that a wound in the lungs from a ball, would in general do better than a wound in the same part with a pointed instrument; and this difference in effects would appear in many cases to arise from the difference in the quantity of blood extravasated; because the bleeding from a ball is very inconsiderable in comparison to that from a cut; and there is



therefore a less chance of extravasated blood, either in the cavity of the thorax, or the cells of the lungs; another circumstance that favours the gun-shot wounds in these parts, is, that they seldom heal up externally by the first intention, on account of the slough, especially at the wound made by the entrance of the ball, so that the external wound remains open for a considerable time, by which means any extravasated matter may escape; but even this has often its disadvantages, for by keeping open the external wound, which leads into the cavity, we give a chance to produce the suppurative inflammation through the whole surface of that cavity, which most probably would prove fatal, and which would be equally so if no viscus was wounded; but it would appear that the cavity of the thorax does not so readily fall into this inflammation from a gun-shot wound as we should at first imagine; nor can we suppose that the adhesive inflammation readily takes place between the lungs and plura round the orifice, as we described in the wounds of the abdomen, because these parts are not under the same circumstances that other contained, and containing parts are; for in every other case, the contained and containing have the same degree of flexibility, or proportion in size. The brain and the scull have not the same flexibility, but they bear the

same proportion in size. From this circumstance, the lungs immediately collapse, when either wounded themselves or when a wound is made into the chest, and not allowed to heal by the first intention, and become by much too small for the cavity of the thorax, which space, must be filled with air or blood, or both, therefore adhesion cannot readily take place; but it very often happens that the lungs have previously adhered, which will frequently be an advantage.

In the cases of stabs, especially if with a sharp instrument, the vessels will bleed freely, but the external wound will collapse, and cut off all external communication. If the lungs are wounded in the same manner, we must expect a considerable bleeding from them; this bleeding will be in the general cavity of the thorax (if the lungs at this part have not previously adhered there,) and likewise into the cells of the lungs or bronchea, which will be known by producing a cough, and in consequence of it a bleeding at the mouth; for the blood that is extravasated into the air-cells of the lungs, will be coughed up by the trachea, and by that means will become a certain symptom of the lungs being wounded; but that which gets into the cavity of the thorax cannot escape, and therefore must remain till the absorbents take it up;

which they will do, if it is only in small quantity; but if in large quantity, this extravasated blood will produce symptoms of another kind.

The symptoms of these accidents are;

First, a great lowness, which proceeds from the nature of the parts wounded, and perhaps a fainting from the quantity of blood lost to the circulation; but this will be in proportion to the quantity, and quickness with which it was lost. A load in the breast will be felt, but more from a sensation of this kind, than from any real weight; and a considerable difficulty in breathing.

This difficulty in breathing will arise from the pain the patient will have in expanding the lungs in inspiration, and will also proceed from the muscles of respiration of that side being wounded, and this will continue for some time, from the succeeding inflammation; it will hinder the expansion of the thorax on that side, and of course in some degree of the other side; as we have not the power of raising one side without raising the other;<sup>c</sup> and if wounded by a cutting instrument, the lungs of that side not being able

<sup>c</sup> I have often thought it a great pity, that we do not accustom ourselves to move one side of our thorax independent of the other, as we from habit move one eye-lid independent of the other.

to expand fully, by the cavity of the thorax being in part filled with blood, will also give the symptoms of difficulty of breathing.

The patient will not be able to lie down, but must sit upright, that the position may allow of the descent of the diaphragm, to give room in the chest; all which symptoms were strongly marked in the following case.

A person received a stab behind the left breast with a small sword; the wound in the skin was very small. He was almost immediately seized with a considerable discharge of blood from the lungs, to near a quart, by the mouth, which shewed that the lungs were considerably wounded, for from the situation of the external wound we were sure that the stomach could not be injured. His breathing soon became difficult and painful, and his pulse quick; he was bled; these symptoms increased so fast, that every one thought him dying. He could only lie on his back, for if he lay on the sound side, he could not breathe in the least, and the pain would not let him lie on the unsound side; the easiest position was an erect posture, which obliged him to sit in a chair for several days; when he coughed he was in great pain, very seldom spit with the cough, and never discharged any blood after the second day, by



which we supposed that the bleeding was stopped in the lungs.

While the parts were in a state of inflammation he was in great pain, his breathing excessively quick, and his pulse hard and extremely quick; but as the inflammation went off, he drew his breath in longer strokes, his pain became less, and his pulse not so quick nor so hard; but this last circumstance varied as he moved his body, coughed, or put himself into a passion, which he often did.

I suspected from both the wound and its effects, that there was a good deal of extravasated blood in the cavity of the thorax; for I considered that the blood which got out of the vessels of the lungs into the wound in the lungs, would find a readier passage into the cavity of the thorax, than into the cells of the lungs; and, indeed, every attempt to the dilatation of the thorax would rather act as a sucker upon the mouth of the wound in the lungs, as the pressure of the external air was taken off by that means; I proposed the operation for the empyema, because the extravasated blood must compress the lungs of that side, and hinder their expansion, and likewise irritate, and at last might produce inflammation. He continued for some days with little variation, but upon the

whole seemed getting better; but the day before he died he became worse in his breathing, which we imputed to his stirring too much, and was rather better on the day that he did die: just before death he was taken with a sort of suffocation, and in half an hour he died.

Through his whole illness he had a moist skin, and sometimes sweat profusely; at last his legs swelled.

At first he only took a spermaceti mixture with a little opium, which gave him relief; I wanted to increase the opium, but it was objected to, for fear it should bind the chest too much, as it often does in asthmas, therefore it was given with the squills. On the day that he died, we ordered him the bark with a sudorific.

As this was very different from a common asthma, and the difficulty of breathing arising entirely from the inflammation of the intercostal muscles and lungs, and likewise from having but one lung, I thought it advisable to give opium in this case, as it would take off the irritation of the inflamed parts, and therefore allow a greater stretch or expansion; especially as we found whenever it was given, that it gave relief, and produced these effects.

One might at first wonder why he should breathe with such difficulty, as he had one side

whole or sound; for I have seen people breathe pretty freely who have had but one side to expand; but when we consider the case, we can easily account for this.

After death we opened him. On raising the sternum I cut into the cavity of the thorax, and a great deal of blood gushed out at the incision; we sponged out of the left side of the thorax above three quarts of fluid blood; the coagulum appeared to have been attracted to the sides of the cavity every where, as if it had been furred over with the coagulating lymph, which was nowhere floating in the fluid; but most probably the extravasated blood had never coagulated, and this thick buff crust was an exudation of coagulating lymph from the lungs and pleura which covers the ribs, as in all inflammations; if so, this is another instance, besides that of the inflammation of veins, in which the coagulating lymph coagulates immediately upon being thrown upon the surface, for if it had not, it then must have mixed with the blood in the chest, and only been found floating there.

The lungs were collapsed into a very small substance, and therefore firmer than common; we observed the wound in them which corresponded to the wound in the pleura; I introduced a probe into the wound in the lungs, which passed near four inches, but was not certain

whether it did not make some way for itself; however, I traced the wound by opening the lungs, and could easily distinguish the wounded part by the coagulated blood that lay in it.

I found the heart and inside of the pericardium inflamed, and their surface furred over with coagulating lymph, similar to that on the lungs. The lungs of the right side had also become a little inflamed on their anterior edges.

Wounds in the lungs generally become a cause of a quick pulse; this likewise may arise in some degree from the lungs being so immediately concerned in the circulation, that any thing that gives a check to the blood's free motion through them, may affect the heart. But the pulse becomes hard, which arises from the nature of the inflammation that attends, and also from the wound being in a vital part.

In the cases arising from balls, nothing in general is to be done but to keep quiet, and dress the wounds superficially; for any extravasated blood that might have got into the cavity of the thorax will generally make its escape by the external wound, as also any matter from suppuration. But in the cases of wounds made by cutting instruments, and where there is reason to suspect a considerable quan-



tity of blood in the cavity of the thorax, then we may ask what should be done? and the natural answer is, that the operation for the empyema should be performed. This operation will relieve the patient, and bring the disease to the simple wound, and somewhat nearer to the gun-shot wound; it should be performed as soon as possible, before the blood can have time to coagulate; for the coagulum of the blood may be with difficulty extracted.

The enlargement of the wound already made will often answer; but if that is in such a situation as to forbid dilatation, then the common directions for the empyema are to be followed here.

When all symptoms appear, and we have great reason to suppose a considerable extravasation of blood into the cavity of the chest, I think that we should not hesitate in performing the operation for the empyema.

#### V. *Of Concussions and Fractures of the Scull.*

THESE injuries, in consequence of a musket-ball, differ in nothing from the same accidents arising from any other cause, excepting the lodgment of the ball, which I imagine will require no peculiar mode of treatment.

VI. *Of Wounds compounded with fractured Bones, or containing extraneous Bodies.*

THE compound gun-shot wounds, where bones are broke, or where there are extraneous bodies that continue the irritation, similar to compound fractures, seldom or ever heal at once, or by regular degrees, as in the former, but generally heal very quick at first, upon the going off of the inflammation, similar to the healing of simple gun-shot wounds; but when healed so far, as to be affected by the extraneous bodies, then they become slow in their progress, till at last they come to a stand, or become fistulous; in which state they continue till the irritating cause is removed; and this takes place even if the dilatation should have been made at first as large as could be thought necessary; so that the opening at first, in such cases, can only let out those extraneous bodies or detached bones, that are perfectly loose, or become loose while the wound continues large; however, even this can only take place in superficial wounds; but in those that are deep, or where there is an exfoliation to take place, the dilated part always heals up long before they are fit to make their exit; but before this happens, the

parts often acquire an indolent diseased state, and even when all extraneous bodies are extracted, the parts do not readily heal.

When a wound comes to this stage, surgeons generally put in sponge or other tents into the opening, or apply some corroding medicine to keep it open, and also with a view to make it wider; but this practice is unnecessary, as a wound in such a state seldom heals entirely over, nor do tents add much to the width of the wound, and always confine the matter between the two dressings.

Where an exfoliation is expected, it is generally better to expose as much of the bone as possible; it keeps up a kind of inflammation, which I imagine gives a disposition for this process. This can only be done where the bone is pretty superficial; but in cases where the separation has already taken place, and it is now to make its way to the skin, like any other extraneous substance, then, instead of the practice of sponge tents, to keep the orifice in the skin open, it would be often better in such cases, to let the whole heal over, because the extraneous body would form an abscess round itself, which would enlarge the cavity, and produce the ulcerative inflammation quicker towards the surface; and when that was opened, the extraneous body could be with more ease extracted, or would

come out of itself; but this method of healing the mouths of fistulous sores is not always practicable.

If this last practice has no inconveniences attending it, it has this advantage, that the patient has not the disagreeable trouble of having a sore to dress every day, till the extraneous body comes away, which I think is no small consideration. This practice, however, is not to be followed in every case; for instance, if the wound should communicate with a joint, as is common to most sores in the foot and hand, where the bones are diseased, it would be, in such cases, very imprudent to allow the wound to heal, as the confined matter would get more readily into the different joints, and increase the disease; there may be other causes to forbid this, as a general practice.

If wounds are to be kept open at their mouths, whose bottoms have not a disposition to heal, they should be kept open to that bottom; because, whenever they do heal at their mouths, it is most commonly owing to their sides underneath first uniting; for the skin will seldom unite when all beyond it is open.

In wounds that become fistulous, where there is no extraneous body, there is always a diseased body, which is to be looked upon as having the same effect as an extraneous sub-



stance. To alter this diseased disposition, they should be opened freely, as large openings produce quick inflammation, quick suppuration, and quick granulations, which are generally sound when they arise from such a cause; on the other hand, letting such wounds heal at their mouths, has often a salutary effect, as it becomes a means of destroying this diseased part by the formation of an abscess there, and in general, there can be no better way of coming at a part or extraneous body, than by the formation of an abscess there. It is a natural way of opening to relieve diseased parts; but we often find in practice, that this method is not sufficient, either for the extraction of extraneous bodies, or to expose the diseased bottom, excepting these abscesses are opened very largely by art, so as to expose the whole of the diseased parts or extraneous body.

#### VII. *Of the Time proper for removing incurable Parts.*

MANY gun-shot wounds are at the very first evidently incurable, whether in a part that cannot be removed, or in one that will admit of being removed. When such wounds are in parts that will not admit of a removal of the

parts injured, then nothing can be done by surgery; but when in a part that can be removed, then a removal of the injured part is to be put in practice; but even this is to be under certain restrictions: perhaps it should not be done immediately upon the receiving of the injury, excepting where a considerable blood-vessel is wounded, so as to endanger the life of the person, and that it absolutely cannot be taken up; or it is suspected that the inflammation, in consequence of the accident, will kill; by which means you have only the inflammation in consequence of the amputation; but this is a bad resource, especially if it is a lower extremity that is to be amputated, and which is perhaps the only part that can be removed of which the inflammation will kill.

How far the same practice is to be followed in cases which we may suppose will not kill, but that the part is so hurt, as to all appearance not to be in the power of surgery to save, I will not now determine. This is a very different case from the former, and its consequences depend more upon contingences, so that the part should be removed only when the state of the patient in other respects will admit of it; but this is seldom the case, for few people in full health are in that state, and still less so those who are usually the subjects of gun-shot wounds;

the situation they are in at the time, from the hurry of mind, makes it here in general to be the very worst practice; it will in general, therefore, be much better to wait till the inflammation, and all the effects of both the irritation and inflammation shall be gone off.

If these things are not sufficiently attended to, and the first inflammation, as in the first stated case, (for instance, that which is likely to prove mortal) is allowed to go on, the patient will most probably lose his life; or if the first inflammation is such as is likely to go off, according to the last stated case, then we should allow it to go off before we operate, and not run the risk of producing death by an operation; for I have already observed, few can support the consequences of the loss of a lower extremity when in full health and vigor: we know that a violent inflammation will in a few hours alter the healthy disposition, and give a turn to the constitution, especially if a considerable quantity of blood has been lost, which most probably will be the case where both accident and operation immediately succeed one another.

The patient under such circumstances becomes low, simply by the animal life losing its powers, and hardly ever recovers afterwards.

After considering the curative treatment of gun-shot wounds, and other accidents common

to the soldier, as also the sailor, let us further consider the treatment of those patients, whose wounds at the very first appear to be incurable, when they are in parts that will admit of being removed.

The operation itself is the same as in other cases, and the only subjects of peculiar consideration here are the situation of the patient, and the proper time for performing the operation after the injury.

I have already given some directions with regard to the proper time of operating, in treating upon the dilatation of gun-shot wounds, which are in some degree applicable here; but we shall consider this now more fully, as the proper time of removing a part is often much shorter than that of dilating.

Amputation of an extremity is almost the only operation that can, and is performed immediately on receiving the injury.

As these injuries in the soldier are generally received at a distance from all care, excepting what may be called surgical, it is proper we should consider how far the one should be practised without the other. In general, surgeons have not endeavoured to delay it till the patient has been housed, and put in the way of a cure; and, therefore, it has been a common practice to amputate on the field of battle;



nothing can be more improper than this practice, for the following reasons. In such a situation it is almost impossible for a surgeon, in many instances, to make himself sufficiently master of the case, so as to perform so capital an operation with propriety; and it admits of dispute, whether at any time, and in any place, amputation should be performed before the first inflammation is over: when a case is so violent as not to admit of a cure in any situation, it is a chance if the patient will be able to bear the consequent inflammation, therefore, in such a case it might appear, at first sight, that the best practice would be to amputate at the very first; but if the patient is not able to support the inflammation arising from the accident, it is more than probable he would not be able to support the amputation and its consequences: on the other hand, if the case is such as will admit of being brought through the first inflammation, although not curable, we should certainly allow of it, for we may be assured, that the patient will be better able to bear the second.

If the chances are so even, where common circumstances in life favour the amputation, how must it be where they do not? how must it be with a man, whose mind is in the height of agitation, arising from fatigue, fear, distress, etc.? These circumstances must add greatly to

the consequent mischief, and cast the balance much in favour of forbearance.

If it should be said, that agreeable to my argument, the same circumstances of agitation will render the accident itself more dangerous; I answer, that the amputation is a violence superadded to the injury; therefore, heightens the danger, and when the injury alone proves fatal, it is by slower means.

In the first case, it is only inflammation; in the second, it is inflammation, loss of substance, and most probably loss of more blood, as it is to be supposed that a good deal has been lost from the accident, not to mention the awkward manner in which it must be done.

The only thing that can be said in favour of amputation on the field of battle is, that the patient may be moved with more ease without a limb, than with a shattered one; however, experience is the best guide; and I believe it is universally allowed by those whom we are to esteem the best judges, those who have had opportunity of making comparative observations, with men who have been wounded in the same battle; some, where amputation had been performed immediately, and others where it had been left till all circumstances favoured the operation; it has been found that few did well

who had their limbs cut off on the field of battle; while a much greater proportion have done well, in similar cases, who were allowed to go on till the first inflammation was over, and underwent amputation afterwards.

There will be exceptions to the above observations, which must be in a great measure left to the discretion of the surgeon; but a few of these objections may be mentioned, so as to give a general idea of what is meant.

First, it is of less consequence, whichever way it is treated, if the part to be amputated is an upper extremity; but it may be observed, that there will be little occasion in general to amputate an upper extremity upon the field, because there will be less danger in moving such a patient, than if the injury had happened to the lower.

Secondly, if the parts are very much torn, so that the limb only hangs by a small connexion, then the circumstance of the loss of so much substance to the constitution cannot be an objection, as it takes place from the accident; and, indeed, every thing that can possibly attend an amputation; therefore, in many cases, it may be more convenient to remove the whole. In many cases it may be necessary to perform the operation to get at blood-vessels, which may be

bleeding too freely; for the searching after them may do more mischief than the operation.

I have already observed, that gun-shot wounds do not bleed so freely as those made by cutting instruments, and are, therefore, attended with less danger of that kind; however, it may often happen, that a considerable vessel shall be divided, and a considerable bleeding take place; in such cases no time is to be lost, the vessels must be taken up to prevent a greater evil: this operation may, in many cases, be attended with considerable trouble, especially as it will, in general, be on the field of action. Here the sailor has the advantage of the soldier.

It will also be immediately necessary on the field to replace many parts that would destroy the patient if their restoration was delayed, such as the bowels or lungs protruding out of their cavities; to remove large bodies, such as a piece of shell sticking in the flesh, which would give great pain, and do mischief by moving the whole together.

Very little can be done to relieve the brain in such a situation.



VIII. *Of the Treatment of the Constitution.*

BLEEDING is recommended in gun-shot wounds, and in such a manner, as if of more service in them than wounds in general; but I do not see this necessity more than in other wounds that have done the same mischief, and where the same inflammation, and other consequences are expected.

Bleeding is certainly to be used here, as in all wounds where there is a strong and full habit, and where we expect considerable inflammation and symptomatic fever; but if it is such a gun-shot wound as not to produce considerable effects, either local or constitutional, I would not bleed merely because it is a gun-shot wound; and from what I have seen, I think that inflammation, etc. does not run so high in these wounds as I should have at first expected. I believe this is the case with all contused wounds, where death in the part is a consequence: a contused wound is somewhat similar to the effects of a caustic; for while the separation of the dead part is forming, the suppurative inflammation is retarded, and therefore not so violent; but this can only be said of those wounds which are not complicated with any

other injury except what was produced by the balls passing through soft parts; for if a bone is broke, it will inflame like any other compound fracture.

It is often of service in the time of inflammation to bleed in the part with leeches, or by punctures with a lancet; this helps to empty the vessels of the part, to lessen the inflammation sooner, and of course to promote suppuration; but I must own that bleeding must be used with great caution, where inflammation and fever run very high, for to reduce the patient equal to the action at the time (which, whether an increased action, or an acquired one, is only temporary) will be reducing him often too much for the constitution to support life, when this action ceases; for the very worst thing that can happen, is the patient being reduced too low: we often afterwards find more difficulty in keeping up with cordials, bark, etc. than we find in lowering; and we may avail ourselves of observing those who have lost considerable quantities of blood from the accident, which is always immediate, and we find too, that a second bleeding, by some other accident, although very small in quantity, often destroys our patient very quickly; but this will in a great measure depend upon the seat of the injury; for in cases of great violence done to some

parts of our body, bleeding answers better than in others, because the symptoms of dissolution, and dissolution itself, come on sooner from mischief done to some parts, than when it is done to others.

A man will bear bleeding better after an amputation of the arm than the leg; better after a compound fracture of the arm than the leg; he will bear bleeding better after an injury done to the head, chest, the lungs, etc. than to either the arm or leg.

We find that injuries done to inactive parts, such as joints, do worse, and are more susceptible of irritation than those in fleshy parts of the same situation.

It would appear upon the whole, that the decay of animal life is sooner brought on when the inflammation is in a part whose circulation is not so strong, and where the nervous influence, or the force of the circulation, is far removed.

Bark is greatly recommended in gun-shot wounds, and with good reason; but it is ordered indiscriminately to all patients that have received such wounds, whatever the symptoms or constitution of the patient may be. That there is no better medicine for wounds in general; not only when the inflammation is gone off, but in the time of inflammation, if the patient is rather

low; and, indeed, before it comes on, experience daily shews. Bark is to be looked upon as a strengthener, or regulator of the system, and an antispasmodic, both of which destroy irritation; the bark and gentle bleedings, when the pulse begins to rise, are the best treatment that I know of in inflammations that arise either from accidents or operations; one lessens the volume of the blood, and the increased animal powers at the time, which makes the circulation more free; so that the heart labours less, and simple circulation goes on more freely; the other gives to the blood that which makes it less irritating, makes the blood-vessels do their proper offices, and gives to the nerves their proper sensations, which take off the fever.



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## EXPLANATION OF THE PLATES.

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### *PLATE FIRST.*

IN this plate is represented the embrio of the chick in the incubated egg, at three different stages of its formation, beginning with the earliest visible appearance of distinct organization. The preparations from which these figures are taken form part of a complete series, contained in Mr. Hunter's collection of comparative anatomy. They are meant to illustrate two positions laid down in this work, viz. That the blood is formed before the vessels, and when coagulated, the vessels appear to arise; that when new vessels are produced in a part, they are not always elongations from the original ones, but vessels newly formed, which afterwards open a communication with the original.

#### FIGURE I.

In this figure the only parts that are distinctly formed, are two blood-vessels; on each side of these is a row of small dots or specks of coagulated blood, which are afterwards to become blood-vessels.

#### FIGURE II.

The formation of the embrio is further advanced, vessels appear to be rising up spontaneously in diffe-

rent parts of the membrane; and the specks, out of which they are produced, are in many parts very evident.

FIGURE III.

The number of blood-vessels is very considerably increased; they now form a regular system of vessels, composed of larger trunks, and a vast number of ramifications going off from them.

## PLATE SECOND.

This plate represents a section of the human uterus in the first month after impregnation. The uterus itself is a little enlarged in size, and thickened in its substance; its cavity every where lined with a coagulum of blood, having a smooth internal surface, but adhering firmly to the uterus.

The arteries are injected, to shew that it is uncommonly vascular, and vessels are found to be injected in different parts of the coagulum.

The object of this plate is to shew the readiness with which vessels are formed in coagulated blood, when attached to a living surface, and its vascularity being to answer useful purposes in the machine; of which this is a remarkable instance, as it is to form the outer membrane of the fœtus or the connecting medium between it and the uterus.

### FIGURE I.

A longitudinal section of the uterus, in which the cavity is exposed.

- A. The os tincæ projecting into the vagina, of which there is a small portion, to shew the length to which the os tincæ projects.
- BB. The cervix uteri.
- CCC. The coagulated blood smooth upon its internal surface, although extremely irregular.
- DD. The cut surface of the substance of the uterus, which has so intimate a connexion with the coagulum that the one appears to be continued into the



other. The laminated appearance is produced by the section of enlarged veins in a collapsed state, which are extremely numerous.

FIGURE II.

Is a thin slice of the substance of the uterus and the coagulum adhering to it, dried, and viewed in a microscope, to shew the vascularity of the uterus, whose vessels are distinctly seen, continued into the coagulum, and passing about halfway through its substance.

*PLATE THIRD.*

This represents a front view of the human testicle, upon the body of which is a coagulum of blood adhering to it. For the better understanding this plate it will be necessary to give at length the history of the case.

A man came into St. George's Hospital with an hydrocele, for which he was tapped with a lancet. When the water was evacuated, the testicle was larger to the feel than common, and in a month the tunica vaginalis was as much distended as before the operation. The radical cure was now determined upon; the tunica vaginalis was slit open, but the testicle being enlarged it was thought proper to extract it. Upon the body of the testicle was found a coagulum of blood, resembling a leech in appearance, and in the angle between the testicle and epididymis, was another smaller one; at some parts it adhered to the testicle and epididymis, and at others it was loose from both.

The adhesion of the large coagulum was firm, although it admitted of a separation, which was made at one end; when separated, fibres were plainly seen running between it and the testicle. The adhesions of the small coagulum were in many places still firmer. This blood had been extravasated by the puncture made with the lancet in drawing off the water, and had fallen down upon the testicle, where it coagulated.

Over the whole surface of the tunica vaginalis there were vessels filled with blood, and clots of extravasated blood in different parts.

## FIGURE I.

The testicle, with the tunica vaginalis slit open, exposing its surface:

AA. The body of the testicle.

B. A small hydatid arising from its surface, which occurs not unfrequently in that situation, viz. just where the epididymis takes its origin from the testicle.

C. The smaller coagulum lying in the angle between the body of the testicle and the epididymis.

D. The large coagulum adhering to the body of the testicle.

EEE. The tunica vaginalis turned back.

## FIGURE II.

A portion of the tunica vaginalis magnified to shew the appearance of its vessels, and of the small specks of extravasated blood in different parts.

*PLATE FOURTH.*

In this plate we have a different view of the same testicle, after the vessels were injected, very much magnified, by which means they were rendered more conspicuous. The whole surface of the testicle now appeared to be a layer of coagulating lymph become vascular.

The surface of adhesion of the larger coagulum was injected for about one-twentieth part of an inch, and extremely full of distinct vessels.

The smaller coagulum was in many places injected through and through, in others only for a little way along the surface of adhesion.

AA. The layer of coagulating lymph covering the testicle.

B. The hydatid.

CCC. The smaller coagulum more exposed than in plate third, and the vessels running upon different parts distinctly seen. The lower portion is detached at one end, and was only vascular at the neck, by which it adhered.

DD. The large coagulum.

EEE. The tunica vaginalis turned back.



## PLATE FIFTH.

Represents two rabbit's ears, one in the natural state, the other in an inflamed state, in consequence of having been frozen and thawed.

The vessels are injected, and as they belonged to the same head, the force applied, and other circumstances must have been exactly similar.

The difference in the size of the vessels, and the difference in the thickness of the ears themselves, is very evident; but there was an opacity in the inflamed ear compared with the other, which it was not possible to express.

### FIGURE I.

The ear in its natural state.

AA. The projecting part of the ear.

B. That part which is covered by the skin of the head.

CCC. The principal arterial trunk.

### FIGURE II.

The inflamed ear.

AA. B. CCC. represent the same parts as in figure one.

D. A branch rather larger than the trunk, not distinguishable in the natural state of the ear.

*PLATE SIXTH.*

## FIGURE I.

A portion of the ilium taken from the intestines of an ass. The intestine was in a state of inflammation, and shews the internal surface of the gut partly covered by a layer of coagulating lymph thrown out by the great degree of inflammation which the parts had undergone.

The internal membrane was extremely vascular, and when injected, vessels were seen in portions of the coagulating lymph.

AA. The inner surface of the intestine.

BB. The coagulating lymph which adhered to it.

## FIGURE II.

The peritoneal coat of a portion of the human intestine, in an inflamed state, to shew its vascularity, and to shew a small portion of coagulating lymph attached to it by a narrow neck, which is supplied with vessels from it.

*PLATE SEVENTH.*

A ramifying portion of coagulating lymph coughed up from the lungs. The history of the case is as follows:

A man, aged twenty-two, naturally healthy, had his constitution much weakened by a severe course of mercury, which brought on a very violent cough; he expectorated a quantity of mucus, often mixed with blood. His pulse became so irregular as not to be counted, and he generally felt a cutting pain in his chest.

In a fortnight from this attack, he began coughing up small pieces of coagulating lymph, like worms; these always produced a fit of coughing in their expulsion, and left an excessive soreness in some part of the chest; these portions were very numerous, increased in size, and had a branching appearance; the fits of coughing became also more violent. The specimen here represented was one of the largest; as they increased in size, the fits became less frequent, and at length disappeared, and the man got well. The patient was under the care of Mr. Saumarez, of Newington Butts, who gave the preparation to Mr. Hunter.

## PLATE EIGHTH.

This represents the uterus and vagina of an ass, on which the experiments were made to produce inflammation upon its internal surface. The inflammation was followed by an exudation of coagulating lymph, an effect which is only produced on the inner surface of a canal opening externally by inflammation in its greatest degree of violence.

The vagina is slit open on the opposite side to that represented in this plate, and the uterus is opened on the exposed side, shewing a coagulum, the end of which is in the beginning of the horn ; the other horn is not opened.

- A. The vagina slit on the opposite side.
- BB. The common uterus slit open, which exposes the coagulum.
- CC. One of the horns of the uterus slit open at its junction with the common cavity, in which lay the extreme end of the coagulum.
- D. The other horn unopened.
- EEEE. The coagulum hanging down from the vagina, to which it adhered, but loose at the lower extremity.

FINIS.





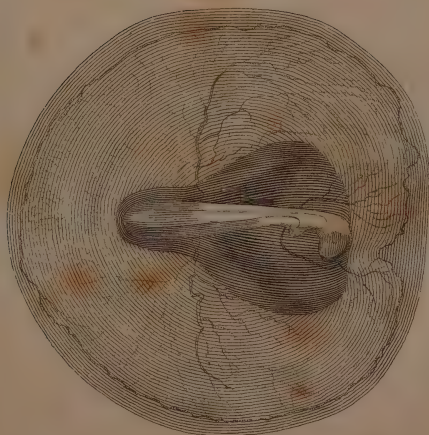
*Fig. 1.*



*Fig. 2.*



*Fig. 3.*





*Fig. 1.*



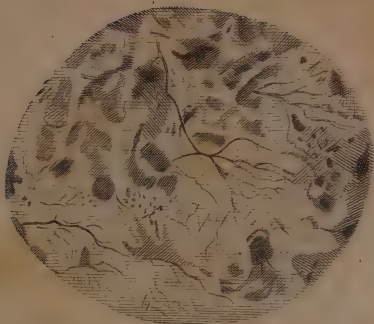
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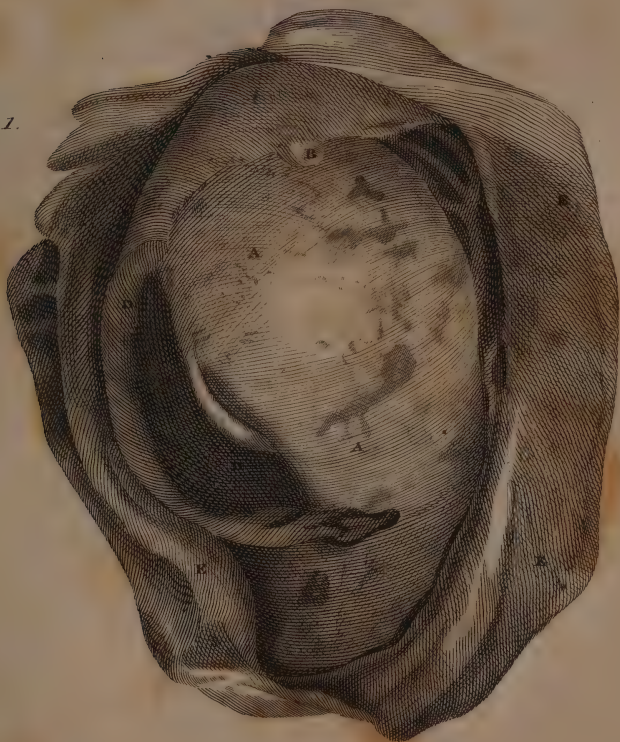




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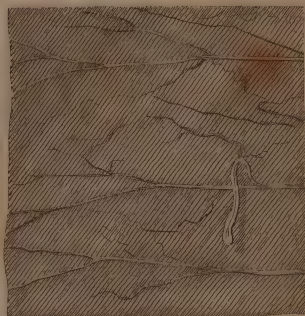
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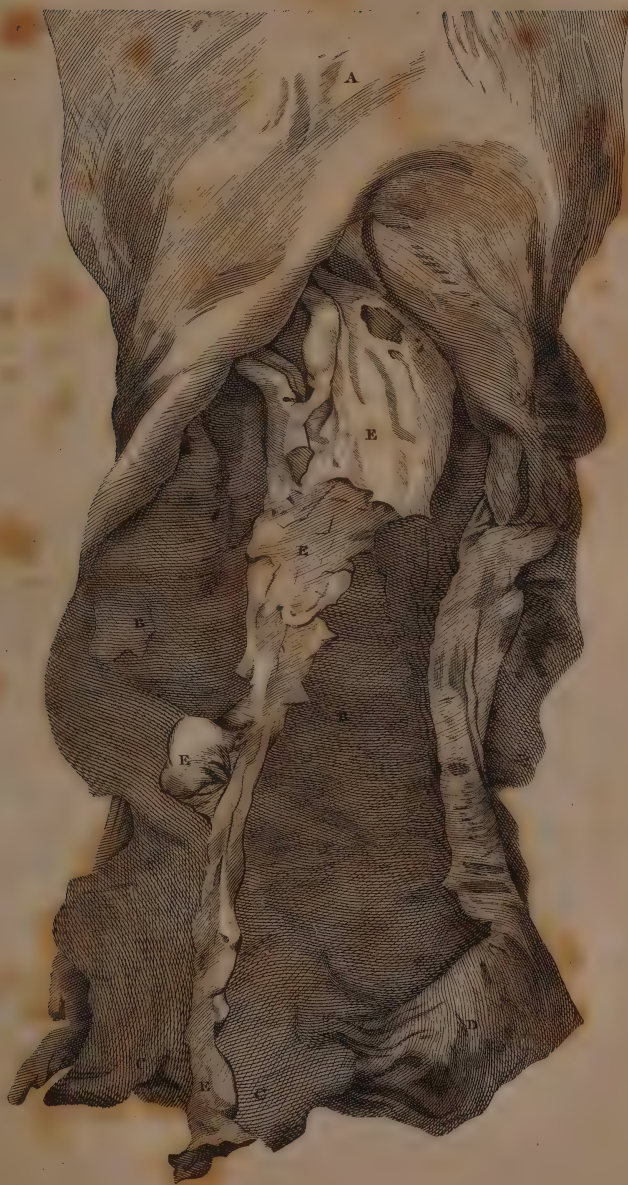


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